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DENTAL FORMULARY

HERMANN PRINZ

ROYAL COLLEGE OF DENTAL SURGEONS OF ONTARIO

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PREAMBLE.

The lecturer must not be the ant, collecting all things indiscriminately from all quarters, as provender for his discourses;

Nor the spider, seeking no materials abroad, but spinning his web of speculative doctrine from within himself;

But rather the bee, extracting crude honey from various flowers, storing it up in the recesses of his brain, and submitting it to the operation of his internal faculties, until it be matured and ready for use.

LORD BACON.

DENTAL FORMULARY

A PRACTICAL GUIDE FOR THE PREPARATION OF CHEMICAL AND TECHNICAL COMPOUNDS AND ACCESSORIES AS USED IN THE OFFICE AND LABORATORY BY THE DENTAL PRACTITIONER

WITH

AN INDEX TO ORAL DISEASES AND THEIR TREATMENT

BY

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THIRD EDITION, THOROUGHLY REVISED

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PREFACE TO THE THIRD EDITION.

THE second edition of the *Dental Formulary,* including many reprints, has been exhausted for some time past. Owing to numerous other duties, unavoidable delay was caused in the preparation of the manuscript for the third edition.

The new edition of the *Dental Formulary* has been completely revised; many important additions have been made, especially in regard to recent improvements concerning the preparation of investment compounds, impression waxes, etc., and in the chapter dealing with the preparations for the mouth and teeth. The index to oral diseases has been completely rewritten. The matter which has become obsolete has been discarded. A number of recipes have been modified according to present needs, and many tests have been carried out to verify the composition and usefulness of pharmaceutical and technical compounds. Only those formulas are presented which have been shown to possess real merit and to be worthy of an extended trial at the hands of the profession. An earnest effort has been made to present the whole matter so as to be of assistance to professional colleagues in their daily tasks.

The writer again emphasizes what he has stated in the preface of former editions, namely that each formula as specified in this book, may be simply regarded as representing a basic compound; it may be employed as such or modified to suit conditions at hand. In general, however, it should be remembered that most of these formulas, especially those of a technical nature, represent the practical experience of mature minds who are known as experts in their respective branches.

It is gratifying to know that a Spanish edition of the *Dental Formulary* has appeared some time ago, and that a German edition is to be published in the very near future.

The author wishes to thank his many professional friends who have assisted him most generously in the preparation of the third edition of the *Dental Formulary*.

H. P.

Evans Dental Institute;
University of Pennsylvania,
1923.

FROM THE PREFACE TO THE FIRST EDITION.

The many inquiries regarding formulas for technical and chemical compounds, or special methods of procedure relative to the treatment of oral diseases, received from dental practitioners, has been the prime incentive in the preparation of this volume.

Its object is to furnish to the practitioner and the student a reliable guide for technical information as needed in the office and laboratory of a busy practice. No claim of originality is made for all the recipes and formulas—such complexity is rarely the product of a single brain. Due credit has been given wherever originality could be clearly established. The matter has been gleaned from English, German and French current literature and other sources.

The author has carefully selected, modified when necessary, and in the majority of cases made tests to establish reliability. Each formula as represented in this work may be simply regarded as a basis; it may be employed as such or modified to suit the conditions at hand. In general, however, it should be remembered that most of these formulas represent the practical results of mature minds who are known as experts in their specific branches. Formulas, recipes, and special processes as published in the dental journals, and even in text-books are frequently selected at random without due consideration of their practicability or their trustworthiness; they often contain mistakes which naturally produce unreliable and, under certain conditions, dangerous results.

The book is primarily intended to be a practical guide, consequently all scientific theories or matters of controversy have been purposely omitted. While the author feels he has covered a wide field, yet he is aware of the fact that the book is of necessity incomplete in many respects. This, however, may be expected of any work of its size and nature.

Whether a book of the nature of a dental formulary is needed by the English speaking practitioner, the future has to decide. Similar works published in German and in French have been successful. It is the intention of the author to continue the task before him, keeping the book up to date by constantly enlarging and modifying future editions according to need.

H. P.

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DENTAL FORMULARY.

CHAPTER I.

PLASTER-OF-PARIS PREPARATIONS, SEPARATING MEDIA, CAST VARNISHES, INVESTMENT COMPOUNDS FOR METALLIC PLATE BASES AND CAST INLAYS, MOULDING MATERIALS, ETC.

TO COLOR PLASTER-OF-PARIS IMPRESSIONS.

Dissolve a few crystals of red aniline (eosine or Scarlet B.) in the water which is to be used for mixing the plaster of Paris.

TO INCREASE THE COHESION OF PLASTER OF PARIS FOR IMPRESSION PURPOSES.

Add to the freshly mixed plaster of Paris a small quantity of loose fibers of absorbent cotton.

IMPROVED IMPRESSION MATERIAL.

1.

Plaster of Paris	10 parts
Powdered asbestos	12 "
Powdered chalk	4 "
Marble dust	1 part

2.

Powdered sand	3 parts
Powdered chalk	3 "
Marble dust	3 "
Plaster of Paris	6 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The compound may be colored with mineral red, crocus martis, etc. Low fusible alloys may be readily poured into the dried and warmed impression made of these compounds.

TO HARDEN PLASTER-OF-PARIS CASTS.

1.

Borax	1 part
Water	50 parts

Boil the dried plaster cast in this solution.

2.

Prepare a saturated solution of sodium bicarbonate and place the dried cast in this solution until it is saturated with it. Remove and dry.

3.

Prepare a saturated solution of boric acid in hot water and add sufficient water of ammonia to form a soluble ammonium borate. Mix the plaster with this cold solution or saturate the dried cast with it. In a few days the cast will be sufficiently hard to allow polishing with a soft wheel brush.

4.

Freshly slaked lime, sifted	1 part
Plaster of Paris	6 parts

Mix with hydrant water.

The thoroughly dried cast made of this mixture is placed in a saturated aqueous solution of zinc sulphate or iron sulphate and kept in the respective solution for two hours. It is then removed and dried. Zinc sulphate does not alter the white color of the cast, while iron sulphate produces a light green shade which, in time, gives an "oxidized" appearance to the cast. Casts prepared according to this method are about twenty times as hard as ordinary plaster casts.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

5.

The plaster cast is dried at about 250° F. until it is deprived of all moisture. It is now placed in a hot aqueous solution of barium hydrate (5 per cent) and kept there until saturated. The cast is removed, dried and smoothed with fine sandpaper and placed in a 10 per cent aqueous solution of oxalic acid, in which it remains a few hours. The color of the cast is not altered by this treatment. If a permanent tint is required, the plaster cast is placed, prior to the above treatment, into a saturated solution of copper sulphate, or iron sulphate, or chrome sulphate, thus producing, respectively, bluish, greenish, and orange tints. (Wachsmuth's process.)

6.—Marbleized Plaster-of-Paris Casts.

Powdered alum	4 parts
Ammonium chloride	4 "
Plaster of Paris	17 "

Mix thoroughly, stir in water, and cast in the ordinary way.

7.—Encaustic Plaster-of-Paris Casts.

Heat the plaster cast to about 175° F.; place into melted stearic acid and keep in this liquid from three to five minutes; remove dry and burnish with a soft brush until an even polish is obtained. Larger plaster casts may be saturated with a solution of

Stearic acid	3 parts
Gasoline[1]	20 "

After the evaporation of the gasoline the cast is treated as outlined above.

---

[1] In all cases where gasoline or benzine is recommended for preparing solutions of fats, oils, resins, rubber, etc., for technical purposes, carbon tetrachloride is preferably employed. Carbon tetrachloride (CCl_4), commercially known as "Carbona" and by other proprietary names, is a non-inflammable efficient substitute for the above hydrocarbons.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

8.—Beerite.

Very fine marble dust	100 parts
Very fine powdered glass	15 "
Very fine freshly slaked lime	7 "

The carefully mixed and sifted powder is mixed with a thin aqueous solution of sodium silicate (dental silex, soluble glass), and immediately cast into the mould. The cast requires from three to four hours for complete hardening. Beerite produces very hard and sharp casts.

TO HASTEN THE SETTING, AND TO PREVENT EXPANSION OF PLASTER CASTS.

One part of potassium sulphate, or sodium chloride, or alum, dissolved in 8 to 9 parts of water before adding the plaster of Paris, hastens its setting very materially and, to some extent, prevents expansion.

TO RETARD THE SETTING OF PLASTER CASTS.

1.

Mix the plaster of Paris with from 2 to 4 per cent of powdered marshmallow root; the addition of 4 per cent retards the setting of the cast about one hour.

2.

Very small quantities of citric acid (lemon juice) or acetic acid (vinegar), added to the water before mixing the plaster of Paris, will retard its setting.

TO PREVENT WARPAGE OF PLASTER CASTS.

The prompt separation of the cast from the impression will largely obviate warpage.

TO REDUCE THE SIZE OF PLASTER-OF-PARIS CASTS.

Alcohol	1 part
Water	2 parts
Plaster of Paris, enough	to suit

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The cast is allowed to dry for a few days in a warm place. After the alcohol has completely evaporated, the finished cast will be about $\frac{1}{25}$ times smaller in all directions than the original model from which the impression was made. By repeating the process any desired reduction may be obtained.

TO DISSOLVE "SET" PLASTER OF PARIS.

Prepare a cold saturated solution of sodium hyposulphite (also known as sodium thiosulphate or as the "hypo" of the photographer) in water and place the plaster-of-Paris cast or article covered with it into this solution. An ordinary dental cast, when placed in this solution, will become completely disintegrated within a few hours.

TO REMOVE PLASTER OF PARIS FROM RUBBER PLATES.

Immerse the plate for a half hour in a weak solution of hydrochloric acid, remove, and wash in a weak solution of sodium carbonate.

A SIMPLE MEANS OF REMOVING PLASTER-OF-PARIS BANDAGES.

In spite of the use of special instruments, the removal of plaster-of-Paris bandages, etc., is often troublesome and, in case of a recent fracture, may cause injury. Methods of softening the plaster by water, either alone or with the addition of salt, are rarely successful, as the bandage becomes coated with a layer of grease, which prevents their action. Satisfactory results have been obtained by thoroughly moistening the line of section with strong vinegar applied on a tampon of cotton wool. After a minute the plaster will be found completely softened so that it may be easily divided with a pocket-knife or ordinary scissors—a procedure easy for the surgeon and painless for the patient. By this method a plaster cast for fracture of the femur, consisting of 80 turns of bandage, may be removed in about a minute and a half.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TO REPAIR BROKEN PLASTER-OF-PARIS CASTS.

1.

Celluloid	1 part
Acetone	5–10 parts

Keep well corked and away from fire.

2.

Solution of sodium silicate (dental silex, soluble glass)	1 part

Barium sulphate, enough to make a paste.

3.

Zinc oxyphosphate cement, mixed to a thin cream.

P. S.—The plaster casts must be perfectly dry before any cement can be used successfully.

SEPARATING FLUIDS FOR PLASTER-OF-PARIS CASTS.

1.

Powdered shellac	10 parts
Borax	5 “
Hot water—*not* boiling (150° F.)	100 “

Water-soluble aniline dye, enough to color.

Put the ingredients into a bottle and shake well. The solution will be ready for use in two or three days.

2.

Castor oil	3 parts
Alcohol	1 part

Alcohol-soluble aniline dye, enough to color.

The solution is ready for immediate use.

3.

Scrubbing soap	1 part
Hot water	8 parts

Dissolve and add:

Lard oil	8 parts

Shake well before using.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4.

Boiled linseed oil painted very thin over the impression forms a good separating medium.

SEPARATING FLUID FOR AMALGAM DIES.

Castor oil	1 part
Cocoanut oil	2 parts

IMPRESSION VARNISHES.

1.

Gum sandarac	2 parts
Alcohol[1]	5 “

2.

Gum shellac	1 part
Alcohol	3 parts

VARNISHES FOR PLASTER CASTS.

1.

Gum sandarac	4 parts
Gum mastic	2 “
Venice turpentine	1 part
Alcohol	10 parts

The varnish is colorless, elastic and leaves a fine glossy surface. An alcohol-soluble aniline dye may be added to give the desired tint.

2.

Gum sandarac	1 part
Rosin, light colored	1 “
Alcohol	4 parts

P. S.—Alcoholic varnishes may be made elastic by the addition of 2 parts of castor oil to every 100 parts of the finished varnish.

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[1] Tax-free denatured alcohol, *i. e.*, grain alcohol made unfit for internal purposes by the addition of small quantities of wood alcohol, etc., may be successfully substituted for the high-priced pure grain alcohol in all technical preparations.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.—Collodion Varnish.

To 4 parts of sulphuric ether add 2 parts of collodion and 2 parts of "silver gloss" (to be obtained from dealers in painters' supplies). Let the mixture stand for forty-eight hours, and shake well before using, Keep well corked.

4.—Dental Silex.

Commercial solution of sodium silicate, also known as liquid or soluble glass, is diluted with 2 to 3 parts of warm water. Let stand for a few days and pour off the supernatant clear solution.

MOULDS FOR DUPLICATING PLASTER CASTS FROM ORIGINAL CASTS OR MODELS.

1.

Fresh slaked lime	10 parts
Sugar	10 "
Glycerin	12 "

Dissolve the sugar in the glycerin by heating upon a water-bath, and stir in the lime.

2.

Carpenter's glue	20 parts
Gelatin	20 "
Glycerin	35 "
Water	25 "
Cotton-seed oil	20 "

Place the glue, the gelatin and the water in an enamelled double (rice) boiler, let stand for twenty-four hours, heat until dissolved and add the glycerin and the cotton-seed oil with constant stirring.

Directions: Place the dry, talc-coated model in the moulding flask and pour the warm solution over it. Let it stand until perfectly hard. Carefully remove the cast from the elastic mould. A number of casts may be obtained from the same mould.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Carpenter's glue	200 parts
Water	50 "

Soak the glue in the water over night, pour off the excess and add:

Glycerin	50 parts

Melt over a low fire under constant stirring
until the total mass weighs . . . . 250 parts

PREPARATION AND PAINTING OF DURABLE PLASTER CASTS.

Three parts of plaster of Paris and 1 part of whiting are very intimately mixed by running this mixture through a fine sieve. For a binding fluid a solution of French hare or any other good quality of carpenter's glue, in water, is used. This is prepared by soaking 5 parts of the glue in 100 parts of water for about twelve hours and heating the mixture until solution takes place. A very thick mixture of the powder and the liquid glue is now prepared and, as this cannot be poured, it is carefully painted into the impression with a fine hair pencil. A few more layers are added with the pencil, rocking the tray after each addition to prevent air bubbles, and finally the tray is filled up with a spatula. At least twelve hours are necessary before the cast is separated.

The impression should be well soaped; no oil or varnish must be used. Modelling compound impressions must be perfectly dry.

After separation, the cast should be further dried for about a week, when it is ready to be painted. A thin coat of boiled linseed oil is brushed over the surface and after this is thoroughly dry, the cast is then painted with artist's tube oil colors, thinned down with oil of turpentine. The following list of colors is serviceable for the purpose:

1. Madder lake 3, dark rose.
2. Bright English red.
3. Carmine cinnabar.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4. Light ochre No. 1.
5. Brilliant yellow, light.
6. Terra di Siena.
7. Prussian blue.
8. Parisian ultramarine.
9. Green, light cinnabar.
10. Burned Terra di Siena.
11. Ivory black.
12. Kremnitz white.

Kremnitz white (a fine quality of white lead), mixed with carmine cinnabar is to be used to represent normal mucous membrane, while inflamed membrane will be nicely represented by madder lake mixed with light ochre; white, slightly blended with light ochre, produces a color similar to that of the teeth. The balance of the model is to be painted black.

Water colors may be used for the same purpose; the painted casts must then be varnished.

Aluminum enamel paint makes a good, durable cast varnish and paint combined.

TO BRONZE PLASTER CASTS.

Prepare the cast by sizing it once or twice with boiled linseed oil. The dried cast is now bronzed with any desirable shade of either dry or wet bronze.

CLEANING OF PLASTER CASTS.

1.

Make a thick paste of powdered cornstarch and hot water, and, with a soft brush, paint the hot mixture evenly over the cast. The layer of starch must be quite thick. After drying slowly, the starch will split and may be scalded off with the dirt without injury to the cast.

2.

Prepare a saturated solution of boric acid in ammonia water, place the dried cast in this solution until thoroughly saturated; remove and dry.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

MOLDINE.

Pure dry clay is mixed with sufficient glycerin to make a plastic mass.

TO RESTORE HARDENED MOLDINE.

Place the moldine in a vessel and cover with a mixture of

Glycerin	1 part
Water	9 parts

Boil, under constant stirring, until the water is evaporated.

PLASTILINE.

(Artificial Modelling Clay).

Lard	50 parts
Washed sulphur	30 "
Clay	14 "
Zinc oxide	6 "

MOULDING SAND.

Moulder's sand, a fine quality	3 parts
Powdered clay	1 part

Mix with

Glycerin	1 part
Water	2 parts

OILED MOULDING SAND.

Best dry moulding sand	5 parts
Sperm oil	1 part

INVESTMENT COMPOUNDS FOR SOLDERING, CHEOPLASTIC CASTINGS, ETC.

1.

Plaster of Paris	4 parts
Moulding sand	4 "
Fire clay	1 part

Mix and pass through a fine brass wire sieve.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Anthracite coal ash	20 parts
Plaster of Paris	30 "
Powdered soapstone	3 "
Mineral red	2 "

3.

Plaster of Paris	7 parts
Asbestos powder	5 "
Powdered soapstone	1 part

4.

Plumbago	1 part
Calcined marble dust	1 "
Plaster of Paris	2 parts

5.

Powdered soapstone	1 part
Plumbago	3 parts
Asbestos, grade No. 3	5 "
Plaster of Paris	7 "

6.

Plaster of Paris	7 parts
Silex	14 "
Graphite, powder	12 "

7.

Plaster of Paris	33 parts
Silica, fine	45 "
Silica, coarse	22 "

8.

Red bird gravel	1 part
Plaster of Paris	2 parts

P. S.—1. Pumice stone should not be used in an investment compound. Pumice stone is a form of vulcanic glass

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

which readily melts when heated, thereby edging the enamel of the artificial teeth.

2. Borax and silicates in the form of sand, etc., which are present in many investment compounds, readily unite, even at a low heat, to form a low fusing glass which may run over the teeth during soldering. The teeth become rough and covered with numerous small cracks.

INVESTMENT COMPOUNDS FOR GOLD CAST INLAYS, ETC.

1.

English china clay	2 parts
Powdered pure sand	2 "
Plaster of Paris	3 "

2.

Powdered soapstone	1 part
Powdered asbestos	9 parts
Plaster of Paris	10 "
Powdered pure sand	10 "

3.

Plaster of Paris	12 parts
Powdered silex	5 "
Powdered Ceylon graphite	3 "

4.

Powdered mica[1]	1 part
Marble dust	1 "
Plaster of Paris	2 parts

5.

Plaster of Paris	2 parts
Powdered silex[2] (lithowhite)	3 "

[1] Powdered mica may be obtained from the United States Mica Mining and Milling Company, at Micanite, Colorado.

[2] Powdered pure sand, silex, lithowhite, "Kiesel" "Kieselguhr" are names given to, more or less, the same substances *i. e.*, impure preparation of silicon oxide. Silex, or lithowhite, may be obtained from the Bridgeport Wood Finishing Company, 72 W. Lake Street, Chicago, Illinois.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

6.

Powdered soapstone	2 parts
Marble dust	2 "
Graphite	2 "
Plaster of Paris	6 "

7.

Plaster of Paris	2 parts
Powdered mica	1 part
Marble dust, pulverized fine	1 "

Quantities are by measure, *not* by weight.

The mica and marble dust should both be powdered as fine as flour.

ARTIFICIAL STONE.

Price.

Calcium hydrate	19 parts
Pure silica	20 "
Aluminum oxide	42 "

DENTAL CONCRETE.

Ward.

Plaster of Paris	17 parts
Flint, No. 200	30 "
Silica XXX	36 "

BAKED CLAY MODELS.

The plaster-of-Paris impression is filled with a hot gelatin or glue solution (see page 19). After cooling, a perfect thick-walled impression of this cast in hard plaster of Paris is prepared, and set aside for a few hours to dry. A good quality of potter's clay is carefully pressed in this impression and set aside in a warm place for two hours to dry. The impression is now carefully removed and the clay model is lightly burned at about 1800° F. in a suitable furnace. The cold model is now coated with a mixture of Majolika enamel and water and burned again. Three colors of enamel are required; pink for representing the mucous surfaces, ivory for the teeth and black for the body of the model.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

FIRE-BRICKS.

When not exposed to mechanical injury a mixture of 1 part (bulk) of fireclay and 3 to 4 parts (bulk) of sawdust, moistened with water and worked into form and burnt, enables a very much higher temperature to be obtained in a furnace than can be obtained with ordinary fire-bricks. In building a furnace of fire-bricks or slabs, fireclay must be used as cement instead of mortar. The fireclay should not be mixed with water as is usually the case, but with a thin solution of silicate of soda. A furnace of this kind is readily adapted to muffles for continuous gum work, crucibles, ladles, etc. If the furnace is required for muffles, a ledge should be left at the back about five inches above the top of the fire box to carry the muffle and the front will have to be built up, leaving a hole for the door about nine inches above the top of the muffle, to enable fresh fuel to be added as required. If the shaft is nine inches wide clear inside, the muffle should not exceed four and a half inches, as room is required on each side to allow the fuel to fall down over the sides of the muffle. If no blower is used a high chimney is required to furnish the necessary draught.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER II.

GUTTA-PERCHA PREPARATIONS, DENTAL RUBBERS, MODELLING AND INLAY WAXES, PLASTIC IMPRESSION COMPOUNDS, ETC.

SOLUTION OF GUTTA-PERCHA.

Purified gutta-percha	10 parts
Chloroform	95 “
Alcohol	5 “

TRAUMATICINE.

Purified gutta-percha	1 part
Chloroform	9 parts
Lead carbonate	1 part

Shake the mixture frequently until complete solution of the gutta-percha has taken place. Set aside for a few days and finally decant the clear liquid. Keep in well-stoppered bottles.

CHLORO-PERCHA.

Gutta-percha base plate	10 parts
Chloroform, a sufficient quantity.	

EUCA-PERCHA COMPOUND, BUCKLEY.

Gutta-percha base plate	480 parts
Menthol	16 “
Thymol	24 “
Eucalyptol	480 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TEMPORARY STOPPING.

1.

White beeswax	1 part
Gutta-percha base plate	4 parts
Prepared chalk	4 “

Melt the wax on a water bath, add the gutta-percha, stir until liquefied, and incorporate the chalk. Knead until thoroughly mixed and pass through a dental rolling mill, having grooved rolls.

2.

Gutta-percha base plate	2 parts
Zinc oxide	8 “
Calcium sulphate	1 part

3.

Dissolve pure gutta-percha in five times its weight of chloroform, allow to deposit, pour the clear solution upon zinc oxide (double the quantity of gutta-percha taken) make into a paste, and spread into sheets, which are cut into suitable pieces.

4.—Flagg.

White beeswax	2 parts
Gutta-percha base plate	6 “
Powdered silex	3 “
Powdered feldspar	3 “

5.—Hill.

Powdered feldspar	1 part
Powdered silex	1 “
Powdered quicklime	2 parts

Gutta-percha base plate, a sufficient quantity to make a stiff mass.

6.—Jacob.

Gutta-percha base plate	1 part
Powdered silex	4 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

7.—Coppered Gutta-Percha.

Gutta-percha base plate	6 parts
Copper oxide, black	6 "
Zinc oxide	12 "

8.—Silver Nitrate Gutta-Percha.

Gutta-percha base plate	2 parts
Zinc oxide	10 "
Silver nitrate	1 part

9.—Aluminum Gutta-Percha.

White gutta-percha base plate	16 parts
Aluminum powder	10 "
Zinc oxide	2 "
Prepared chalk	1 part

10.—Stanno-Percha.

Equal parts by weight of gutta-percha base plate and sifted sponge tin (see page 62) are put in a mortar, the mortar is placed in a heated sand bath and the ingredients are thoroughly kneaded until a grayish-blue mass is obtained. The mass is now divided into two equal parts; the first portion is reserved, while the second portion is again kneaded with an equal amount of sponge tin. The first portion is soft and is used for lining the cavity, while the second (harder) portion is used for the body of the filling.

IMPRESSION GUTTA-PERCHA.

Gutta-percha	35 parts
Zinc oxide	9 "
Vermilion	56 "

IDEAL BASE PLATE.

1.

Black gutta-percha	1 part
Gum shellac	18 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Gum shellac	1 part
Perfection impression compound, Keer	"

Melt the gum shellac on a low fire and gradually add, under constant stirring, the impression compound. Pour on a glass slab and roll with a wet rolling pin to the desired thickness.

3.

Artificial gum shellac (metakaline)	1 part
White beeswax	4 parts

DENTAL RUBBERS.

After Dr. E. Wildman.

Dark Brown.

Caoutchouc	48 parts
Sulphur	24 "

Red.

Caoutchouc	48 parts
Sulphur	24 "
Vermilion	36 "

Dark Pink.

Caoutchouc	48 parts
Sulphur	24 "
Zinc oxide	30 "
Vermilion	10 "

Grayish-white.

Caoutchouc	48 parts
Sulphur	24 "
Zinc oxide	96 "

Black.

Caoutchouc	48 parts
Sulphur	24 "
Ivory, or drop black	24 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Jet Black.

Caoutchouc	48 parts
Sulphur	24 “
Ivory, or drop black	48 “

TO RESTORE HARDENED DENTAL RUBBER.

Place the rubber sheet in warm water, let it soften, remove the cloth sheets and thoroughly brush the rubber with warm soap suds. Wash in warm water, dry the sheets and with a soft sponge dipped in oil of turpentine thoroughly wash over the sheets on both sides. After the oil of turpentine has been absorbed, the rubber is ready for use.

TO MAKE A TRUE RUBBER SOLUTION.

Ethylene dichloride, commonly known as *Dutch Liquid*, and *not* ethyl chloride, gives a true solution, not merely a diffusion of rubber, and has the advantage of being non-inflammable. Its solvent power is greater than carbon disulphide, chloroform and carbon tetrachloride; it has a boiling point of 130° F. and is more volatile than other solvents, and its vapors are non-explosive.

COLD VULCANIZATION.

Sulphur chloride	1 part
Carbon disulphide	30 parts

The rubber cast is plunged in this solution and left there from sixty to eighty seconds. It is now removed, left to dry in a warm room (about one to two minutes) and washed in a weak alkaline solution, *i. e.*, a 2 per cent solution of sal soda in water.

CONSERVATION OF VULCANIZED RUBBER GOODS.

It is claimed by Hempe that the gradual hardening and deterioration of vulcanized India rubber goods is due to the spontaneous evaporation of the solvent liquids contained in India rubber and those introduced during the process of

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

vulcanization. Other observers claim that the evaporation of the solvents, especially in the presence of air and sunlight, or in cold temperature, causes the sulphur present in the vulcanite gradually to oxidize and finally to form sulphuric acid, which, in turn, destroys the rubber. Keeping the rubber goods immersed in a weak alkaline aqueous solution or in paraffin oil, stored away from light at room temperature, will act as a permanent preservative.

According to Larine, there are only three solutions of the many employed in experimental work which have shown themselves to be of practical value, namely, a 3 per cent solution of phenol, a 3 per cent solution of aniline, and an 8 per cent solution of glycerin, with an equal amount of alcohol, in water.

Three per cent phenol is the best method of all. The author has seen tubes that had been immersed for ten years in this liquid which had not altered a particle during this long period; a truly remarkable fact, when we consider the rapidity with which such articles deteriorate in the air. The only precaution to be observed is to have the containers of such size as to prevent kinks. Another advantage is that the liquid does not change its character. The flasks may be opened at any time without the necessity of preparing a fresh solution.

Three per cent aniline acts in a similar manner, though a slight lengthening and increase in volume is noted in the case of black rubber.

Alcohol-glycerin solution has no effect on deteriorated articles, but new rubber goods are preserved when immersed therein.

PRESERVING RUBBER DAM.

Secure only such rubber as is in the best possible condition. Too much care in this direction cannot be exercised. Rubber, being an organic substance, necessarily undergoes a change when exposed to the air and must, therefore, be protected in order to insure its usefulness. To accomplish

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

this end, secure a number of Mason's glass jars, filling the same with pure boiled water and adding to each jar of water a few drops of such antiseptics as phenol or lysol. Then immerse a loose roll of fresh rubber dam in an upright position, taking the precaution to shake out all the air between the folds before screwing on the cover. The jar should at all times be filled with water to the point of overflowing in order to exclude all air. Rubber preserved in the above manner can be kept in perfect condition, if necessary, for a period of about one year. For use, remove the desired amount, dry the rubber and rub down with talcum powder.

STICKY WAX.

1.

Rosin	16 parts
Yellow beeswax	8 “
Vermilion	1 part

Melt on a water bath and stir together, pour on a glass slab and roll with wet fingers into pencils or pour in moulds. (See pages 34 and 36.)

2.

Yellow beeswax	4 parts
Rosin	1 part
Gum damar	1 “

3.

Yellow beeswax	1 part
Rosin	3 parts

4.

Gum damar	1 part
White beeswax	4 parts
Light yellow rosin	7 “

5.

Yellow beeswax	48 parts
Light rosin	84 “
Gum damar	12 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PINK BASE PLATE WAX.

1.

White beeswax	50 parts
Paraffin	25 “
Alkanet root, whole	1 part

Melt the wax and the paraffin and add the alkanet root. Leave on the fire until the desired shade of pink is obtained, strain through cheese cloth into tin moulds, about $\frac{1}{32}$ or $\frac{1}{16}$-inch thick. Have the moulds coated with a film of glycerin. The lids of the tin boxes in which dental rubber is sold make good moulds. To polish the sheet wax, pass between the rubber rollers of a wash wringer.

2.

White beeswax	40 parts
Gum turpentine	10 “
Cotton-seed oil	3 “
Vermilion	4 “

3.

(To be used in hot weather.)

White beeswax	20 parts
Crude turpentine	4 “
Cotton-seed oil	1 part
Vermilion	2 parts

4.

(To be used in cold weather.)

White beeswax	20 parts
Crude turpentine	6 “
Cotton-seed oil	2 “
Vermilion	2 “

5.—Hard Base Plate Wax.

Yellow beeswax	50 parts
Gum mastic	6 “
Prepared chalk	3 “
Vermilion	4 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

6.

Rosin	1 part
Ceresin	3 parts
Paraffin	6 “

7.

Yellow beeswax	1000 parts
Venice turpentine	130 “
Lard	65 “
Red bole	725 “

MAKING SHEET WAX.

1.

Melt the wax in a rather narrow vessel; fill a round, smooth pint bottle with cold water, coat the outer surface with a film of glycerin or soap suds and dip the bottle in the melted wax, quickly remove it and, if the wax coat is not sufficiently thick, dip again. Cut the sheet with a sharp pen knife and immediately flatten out.

2.

Take two pieces of ordinary glass; have both warm, dry and oiled. Place the first piece upon a flat surface and at each corner place a small block of wood of the thickness of the wax desired. Pour a sufficient quantity of the melted wax upon the plate and quickly lay the second glass over the first, pressing the same until each corner touches the gauge blocks.

3.

A porous cell, made for electric batteries, about 3¼ x 7 inches, is filled with cold water, and thoroughly wet all over. Wipe the cell with a damp sponge or cloth to remove superfluous moisture; then with a steady hand plunge the cell down into the wax, and remove rather slowly. The wax should not be too hot—the cooler it becomes the thicker the

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

sheets will be. If very thick sheets are desired a second plunge may be made. Quickly cut the sheets on opposite sides of the cylinder, remove, and place in a pan of cold water. After three or four plunges put fresh cold water in the cell. The sheets may be trimmed by shearing before they become too cold and brittle.

WAX FOR PARTIAL IMPRESSIONS.

Rosin	1 part
Yellow beeswax	16 parts

GOLD INLAY IMPRESSION WAXES.

1.

Yellow beeswax	10 parts
Gum damar	10 "
Yellow ceresin	20 "
Hard paraffin (120° F. melting point)	30 "
Carnauba wax	30 "
Dye stuff	to suit

Melt the beeswax, ceresin, paraffin and carnauba wax in a porcelain dish on a water-bath, add the gum damar in small portions and stir constantly until a uniform mass is obtained. Remove from the fire and add the dyestuff.

Gold inlay waxes should be colored deeply with a dye especially suitable to the needs of the operator. Lamp black or an oil-soluble aniline dye are best suited for this purpose. (The red and blue "Cerasine" or "Sudan Red" aniline dyes are to be recommended.) Gold inlay wax may be cast into sticks as outlined below.

2.—Inlay Impression Wax.

Price.

Stearic acid	110 parts
Paraffin	10 "
Beeswax	15 "
Tamarack[1]	10 "
Gum damar	110 "

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[1] Tamarack is a trade name for American larch turpentine.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

White beeswax	1 part
Hard paraffin	1 "

4.

Yellow beeswax	10 parts
Carnauba wax	30 "
Hard paraffin	50 "

CASTING STICKS OF STICKY WAX, INLAY IMPRESSION WAX, ETC.

Obtain glass tubing of convenient length; the tubing should have fairly thick walls. The bore may be of any diameter, $\frac{3}{16}$ to $\frac{1}{4}$ inch gives convenient sticks of wax. The ends of the tubes should be ground, not melted smooth, as melting lessens the bore at the point of fusion. Thoroughly clean the tubes and dry the inside by pushing pieces of cotton wool through them. The tubes must then be lubricated to prevent the wax from sticking. Do not lubricate with oils; glycerin forms a very effective lubricant for this purpose; and is easily applied by saturating pieces of cotton wool with it and pushing them through the tubes.

Having the wax melted and the tubes lubricated, fill each of the tubes as follows: Attach a piece of rubber tubing to one end of the glass tube; take the other end of the rubber tubing in the mouth. Dip the free end of the glass tube into the melted wax and suck the wax up until the tube is full. Pinch the rubber tubing close to the glass tube, and the tube, full of wax, can then be lifted and laid in a horizontal position. Then release and remove the rubber tubing. The wax will not run out. Repeat the process until all tubes are filled. When cool, the sticks of wax can readily be pushed out of the tubes. If a piece of wax should stick in a tube, it is either because the tube was not properly lubricated or because its bore was not uniform. Pink wax base plate may be cast into sticks for "waxing up" in the same manner, but owing to the much greater fluidity of pink wax when melted, it is more difficult to manipulate.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ENGRAVER'S WAX.

1.

Yellow beeswax	1 part
Tallow	1 “
Burgundy pitch	2 parts

2.

Cotton-seed oil	1 part
Rosin	1 “
Beeswax	2 parts

JEWELER'S WAX.

Heat common rosin in a suitable vessel until it flows freely, then add, slowly, and with constant stirring, plaster of Paris until on dropping a small portion on a plate or marble slab and allowing it to cool, then prying it off with the point of a knife it springs off with a metallic ring. With too little plaster it is soft and bends; with too much it is hard and brittle and loses its adhesiveness. This is used by jewelers for a variety of purposes; to cement pieces of thin metal to chucks for turning, to cement stones into fittings, and tools into metal and wooden handles. It is handy in a dental laboratory for cementing felt and brush wheels to the chucks of the polishing lathe.

IMPRESSION WAX.

Hard paraffin	1 part
Yellow beeswax	7 parts

MODELLING WAX.

1.

Lard	15 parts
Venice turpentine	25 “
Yellow beeswax	200 “
White bole	150 “

Melt the wax, turpentine and lard together, then incorporate the white bole. When a uniform mass is obtained,

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

pour the mixture into cold water. Knead the mass under the water until it assumes a uniform degree of plasticity.

2.

Cotton-seed oil	1 part
Venice turpentine	4 parts
Cornstarch	8 “
Yellow beeswax	16 “
Vermilion	1 part

TO CLARIFY WAX REMNANTS.

1.

Melt about a pound of wax remnants, bring to a boil, and break a fresh egg in the boiling wax, stir for three to four minutes, until the egg is coagulated, and strain through cheese-cloth.

2.

In a flat vessel, having sloping sides, melt a pound of wax remnants in an equal amount of water; stir a tablespoonful of sulphuric acid, added in a slow stream, into the hot wax, let it cool, and cut off the lower sediment.

3.

The wax remnants are melted and strained through cheese-cloth and boiled in

Oxalic acid	1 part
Water	50 parts

On cooling, the wax separates from the oxalic acid solution.

TO FILTER WAX.

The wax may be dissolved in chloroform, carbon disulphide or other solvents, and then filtered through paper in a well-covered heated glass funnel. A simpler method consists in heating the wax with 5 per cent of its own weight with

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

sodium sulphate on a water-bath for about fifteen minutes and then filtering through a cotton plug inserted into a glass funnel surrounded by a hot-water jacket.

TO DETERMINE THE MELTING POINT OF WAXES, FATS, RESINS, ETC.

The material whose melting point is to be determined is carefully melted in a small, perfectly dry beaker, and a capillary tube is dipped into the liquefied substance, and, when filled, one end of the tube is sealed in the flame and it is then put aside in a cool place for several hours. At the end of this time the tube is tied to the bulb of a delicate thermometer, the length of the tube being the same as the thermometer bulb. The thermometer and attached tube are placed in water and gently warmed until the capillary column of the wax, fat, etc., becomes transparent. At this moment the thermometric reading is made, which indicates the melting point of the substance under observation.

MODELLING COMPOSITION.

1.

Stearin	25 parts
Gum damar	50 "
Powdered soapstone	85 "

Carmine, enough to color.

Melt the stearin on a water-bath, add the gum damar, and when melted stir in the powdered soapstone, tinted with the carmine.

2.

Stearic acid	20 parts
Oleic acid	4 "
Gum copal	19 "
Krapplac	17 "
Powdered soapstone	40 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Manila copal	30 parts
Light-colored rosin	30 “
Carnauba wax	10 “
Stearic acid	5 “
Powdered soapstone	75 “

Carmine, enough to color.

4.

Best light-colored rosin	50 parts
Gum copal	2 “
Yellow ceresin	8 “
Gum turpentine	5 “
Powdered soapstone	50 “
Menthol	½ part
Fresh slaked lime	10 parts

Coloring.—Red: Florentine lake. Brown: Crocus martis (iron hydroxide).

5.

Stearin	25 parts
Semi-solid gum copal	25 “
Powdered soapstone	50 “

Carmine, enough to color.

CARVING COMPOUND FOR CROWN CUSPS.

(Metalloid Compound).

Powdered Ceylon graphite	1 part
Perfection impression compound, Kerr	4 parts

Melt the perfection impression compound in a porcelain capsule on a water-bath, add the graphite under constant stirring, and roll or mould into sticks.

ELASTIC COMPOUND FOR CROWN AND PLATE SWAGER.

Gelatin	250 parts
Zinc oxide	175 “
Glycerin	400 “
Water	300 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Mix the zinc oxide with 200 parts of glycerin to a smooth paste; boil the gelatin in the water and the remaining glycerin until dissolved, and stir it into the zinc oxide paste. After twelve hours the mass becomes solid, resembling unvulcanized rubber.

LIQUID CONTINUOUS GUM ENAMEL.

Pink celluloid	15 parts
Oil of cedar wood	5 "
Acetone	30 "

Paint the solution two or three times over that portion of the vulcanite plate which is usually occupied by pink rubber. Each coat must be thoroughly dry before the next is added. Polish with prepared chalk.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER III.

CEMENTS, ADHESIVES, AND VARNISHES.

DENTAL CEMENTS.

Dental cements may, according to their chemical nature, be divided into:

Oxyphosphate of zinc cements,
Oxychloride of zinc cements,
Oxysulphate of zinc cements, and
Silicate cements.

The Oxyphosphate of Zinc Cements.

The oxyphosphate of zinc cements were introduced into dentistry in 1878 by the Rostaing Brothers, of Dresden, under the name of "Dentinogen." On account of the superiority in regard to their wearing qualities over the other dental cements, they at once gained great popularity, and they have become an indispensable medium for certain phases of reconstruction of tooth substances, the attachment of artificial substitutes to natural teeth, etc.

The liquid of the oxyphosphate cements consists of a more or less concentrated phosphoric acid solution, to which is added zinc phosphate, aluminum phosphate, or strontium phosphate, in various proportions, more or less, to the point of saturation.

Commercially, three forms of phosphoric acids are met with:

1. Orthophosphoric acid, U. S. P., H_3PO_4. It is a colorless, inodorous, strongly acid liquid of a syrupy consistency which is miscible with water and alcohol in all proportions. It has

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a specific gravity of 1.710 and contains about 85 per cent of absolute orthophosphoric acid. Besides this acid, weaker solutions (a 50 per cent and a 10 per cent solution) are also found in the market. On standing, the acid gradually deposits crystalline prisms, which are readily redissolved when slightly heated. Orthophosphoric acid readily absorbs water from the atmosphere.

2. Metaphosphoric acid or glacial phosphoric acid; HPO_3. It is found in commerce in glassy sticks or lumps. containing from 10 to 15 per cent sodium metaphosphate, which is added to give tenacity, transparency and hardness to the sticks. The acid is readily soluble in water, the solution gradually changes to orthophosphoric acid. The acid is very hygroscopic.

3. Pyrophosphoric acid; $H_4P_2O_7$. It is a white, hygroscopic, glassy mass which gradually changes to orthophosphoric acid.

A satisfactory acid for dental cement powders may be prepared in the following manner: One part of pure zinc phosphate, 20 parts of glacial phosphoric acid in sticks, and 10 parts of distilled water, all quantities by weight, are placed in a glass-stoppered bottle and set aside in a moderately warm place and occasionally shaken until the solution is completed. The acid is then filtered through a cone of glass wool placed tightly into the neck of a glass funnel. The first portions of the filtrate are returned to the funnel until the solution runs off perfectly clear. The acid is immediately transferred to small glass bottles and tightly corked. Care should be taken to have the bottles perfectly dry. If the cement powder when mixed with the acid hardens too quickly, the latter should be lightly concentrated on a sand bath; if the cement sets too slowly, a very small quantity of distilled water should be added to the acid. Occasionally it will be found that the last part of the acid gives poor results when mixed with the powder; it is then best to discard the fluid instead of trying to remedy the evil by heating, etc. A small office preparation bottle

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with a ground glass cap makes a good container for the acid for office use.

The powder of the oxyphosphate cements consists principally of a pure zinc oxide prepared especially for this purpose, and it is usually referred to as a basic zinc oxide. This basic zinc oxide may be employed in its pure form or more or less tinted with various metallic colors to produce the desired shades. Some makers add small amounts of specially prepared Portland cement to the zinc oxide. It is claimed that the well-known Harvard cement represents a mixture of this kind. Various analyses made have shown that the powder of the Harvard cement contains approximately 87 per cent of basic zinc oxide and 13 per cent of Portland cement.

Portland cement is approximately composed of

Silica	20 to 25	per cent
Aluminum oxide	6 to 8	"
Iron oxide	4 to 5	"
Calcium oxide	60 to 65	"
Magnesium oxide	1 to 2	"

A pure zinc oxide may be prepared by dissolving pure metallic zinc in nitric acid, U. S. P. The solution is evaporated in a porcelain vessel until it solidifies on cooling. The basic zinc oxide may be prepared as follows: One pound of pure zinc oxide, prepared as above, or one of the English preparations known as Hubbuck's or Wilson's, is thoroughly mixed with a $\frac{1}{4}$ ounce of boric acid previously dissolved in water or alcohol. The mixture is tightly packed into a Hessian crucible covered with a fire-clay slab and put into a warm place to dry. Finally it is exposed to a white heat for several hours. After cooling, the crucible is broken, the vitrified zinc oxide is powdered, passed through fine bolting-cloth, and bottled for use. The cement powder thus prepared should not be exposed to the atmosphere, as it readily absorbs moisture. Cement powder may also be prepared by using a mixture of:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Pure zinc oxide	250 parts
Pure magnesium oxide	50 "
Boric acid	5 "

or by mixing pure zinc oxide with a 2 per cent nitric acid solution well diluted with water. The process of vitrification is the same as referred to above. Much of the basic zinc oxide used for dental cements in the United States is imported from Germany; deHaen's Chemical Works, in List, near Hannover, enjoy a wide reputation for making a very pure article, especially adapted for such purposes.

The tinting of the basic zinc oxide is best accomplished by adding suitable mineral colors. Black oxide of manganese, cadmium sulphide and cobalt blue are useful to produce the various shades desired. Only very small quantities are needed. Yellow ochre and Terra di Siena are also used for such purposes, but with less success. By keeping on hand small quantities of the colors referred to above, the various shades may be extemporaneously prepared. (See Appended Formulas for details in preparing the color materials.)

For mixing the cement, a large, thick, polished glass slab and a stiff, non-corrodible spatula are best adapted. Steel spatulas discolor the cement, due to the action of the phosphoric acid and they may precipitate certain chemicals added to the cement powder, as silver, for instance. The best results are obtained by using an agate, bone or Bakelite spatula. "The manipulator who becomes familiar with the proper conditions during the mixing of cement as felt under the spatula will obtain far better results than one relying on the incorporating of definite proportions. In mixing any oxyphosphate, the beginning must be a clean slab and spatula. Then the powder and liquid must be placed thereon sufficiently apart to render it possible to cut in a small addition of powder in a cleanly manner, and incorporate it thoroughly with the liquid, without having a borderland half-mixed, to help impart a clotty condition. Each addition

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of powder must be manipulated until there is the feeling and appearance of a thorough mixture before more powder is added in the same manner. Take plenty of time, making the additions of powder compare to the volume of the mix, *i. e.*, as many separate additions in making a small mix as a larger one." (Ames.)

The temperature of the glass slab should be approximately 60° F.; a little warmer in a cold room, and *vice versa* in a warm room. The humidity of the air also materially influences the setting of the cement.

In connection with the application of oxyphosphate cements the question is frequently asked: Why do pulps die under an oxyphosphate cement filling? Analyses made of various cement powders revealed the presence of certain arsenical compounds in very small quantities which were apparently demonstrated by the arsenical mirror. This test is seemingly erroneous, as Hauser has shown. Cement powders are frequently tinted with ultramarine, a fine blue pigment which is artificially prepared from a mixture of Glauber's salt, charcoal, soda and sulphur. The presence of small quantities of this pigment in the cement powder gives a sulphur mirror which closely resembles that of the arsenical mirror. It should be remembered that arsenical compounds, if present in the oxide, are probably completely volatilized during the vitrifying process of the latter, or they are changed to some inert compound. The dying of the pulps under an oxyphosphate cement filling is probably better explained by attributing it to the chronic irritation resulting from the free phosphoric acid present in an incompletely mixed cement, or to a poorly excavated cavity. Careful excavation and varnishing of the cavity prior to inserting the filling materially reduces the danger.

Hydraulic cements, *i. e.*, such as are used for inlay work, give better results, according to Ames, if the cavity prepared for their reception is slightly moistened with water after it has been previously dehydrated with alcohol.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The Oxychloride of Zinc Cements.

The powder of these cements consists principally of pure white zinc oxide; it is rarely colored. The English zinc oxide (Hubbuck's or Wilson's) is, in general, to be preferred for cement powders. The oxide should be thoroughly dried before it is employed, and kept in well-stoppered bottles to prevent absorption of moisture from the air.

The liquid of the zinc oxychloride cements is usually composed of a concentrated solution of zinc chloride in water. A suitable liquid may be prepared by dissolving 1 ounce of zinc chloride in ½ ounce of distilled water; after standing a few days, it is filtered and the solution is then ready for use. To reduce the quick setting of the cement, a very small quantity of borax may be added to the powder. (See Appended Formulas for details in preparing the cement.)

The Oxysulphate of Zinc Cement.

The oxysulphate of zinc cement is probably best known in dentistry as "Fletcher's Artificial Dentine." The cement consists of a powder which is usually composed of a pure dry zinc oxide to which small amounts of dehydrated zinc sulphate and, sometimes, powdered gum mastic are added. The fluid is composed of a 40 per cent solution of gum arabic in water. (See Appended Formulas for details in preparing the cement.)

The Silicate Cements.

Within recent years much interest has been manifested here and abroad in a new form of dental cements known as silicate cements. These cements are primarily intended to replace gold and, to some extent, porcelain, as employed for filling purpose in the anterior teeth. On account of the translucency of the finished plug, these fillings resemble tooth structure closely, and this is probably the reason why they are so extensively used at present. The silicate cements have been in use for about sixteen years, and of late they have been materially improved. Silicate cements are by no means

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

of recent origin. For technical purposes, they are prepared by mixing liquid sodium or potassium silicate (dental silex) with prepared chalk, calcium oxide, zinc oxide and other suitable chemicals. As a dental filling material such mixtures are not suitable, although they have been experimented with extensively; they require too much time for hardening. Manufacturing chemists have endeavored to incorporate into the powder of these new cements certain silicates, in conjunction with other suitable compounds, which when properly mixed with the ordinary cement liquid (acid phosphate of zinc solution or liquid orthophosphoric acid) form a comparatively quick-setting cement. The resulting filling possesses the hardness of the ordinary phosphate of zinc cement, with an increased resistancy to the fluids of the mouth and a peculiar porcelain-like translucency. A number of analyses have been published relative to the composition of the silicate cement powders, which, with a reasonable percentage of errors, show the following approximate composition:

Quartz	28 to 35	per cent
Kaolin	50 to 55	"
Lime	10 to 12	"
Magnesia	1 to 2	"

Some manufacturers, in the circulars accompanying their cements, lay special stress upon the fact that the extraordinary qualities of their products depend upon certain rare metals, especially beryllium. Beryllium, also known as glucinum, is a rare metal belonging to the magnesium group. Its natural oxides are found in certain parts of France and of Norway, and they also occur in crystalline form as emerald, a gem of pure green color, and in opals. The kaolin mined in St. Yrieux, France, of which the celebrated Limoges porcelain is made, contains beryllium oxide; and this very kaolin, on account of its purity, enters largely into the make-up of some of the silicate cement powders.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

According to a German patent, Ascher's artificial enamel is prepared as follows: A solution of basic beryllium nitrate, $Be(NO_3)_2.2BeO$, is precipitated with sodium silicate. Na_2SiO_3. The precipitate is kept under water for some time. It is then filtered, washed, dried, and lightly calcined. The resultant preparation is ground very fine and mixed with powdered glass or pure china clay.

Schoenbeck's process consists in taking sodium-aluminum fluoride (cryolite), silicic acid and calcium oxide, fusing the same with a beryl admixture up to 5 per cent, cooling and pulverizing, and then adding to the resultant powder a phosphoric acid (meta-, ortho- or pyro-) containing a little aluminum hydroxide in suspension, until a plastic mass ensues.

The making of cements of the silicate group as well as of the oxyphosphate group requires a great deal of technical knowledge which is imperative for its ultimate success. An intimate knowledge of the manufacture of these cements is of less importance to the dentist than certain definite details regarding its manipulation. For this reason the detailed instructions accompanying the various cements should be closely observed to insure success. Test fillings made in extracted teeth are the best means to acquire the necessary technic. For mixing the cement, nothing but a spatula made of some non-metallic, impervious material will do; an agate, bone or Bakelite spatula gives the best service. A few burnishers and round-headed instruments made of agate, Bakelite, bloodstone, or of platinum, gold, nickel and tantulum, or plated therewith, are essential. Metal instruments should be coated with a thin film of vaseline. Silicate cement possesses much less adhesiveness than the oxyphosphate cements, consequently the suitable preparation of the cavity should be duly considered. It should not be packed into the cavity in small pellets, but rather the entire bulk of the filling should be placed at once, pressed into position, and shaped accordingly. Ample time must be allowed for thorough setting under the rubber dam. The filling is

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

polished with strips and discs well vaselined, and after the filling is finished it should be well coated with melted hard paraffin.

To avoid discoloration of the cement in mixing and filling, Ascher has issued the following instructions for the manipulation of his "Artificial Enamel":

Discoloration is absolutely impossible, if the enamel is rightly treated. If the material were at fault, every filling inserted would discolor—not an occasional one, as is generally the case. There are three reasons for discoloration existing.

First—The entering of foreign pigments or secretions into the filling. If the enamel is properly mixed and introduced under sufficient pressure, there is not the slightest porosity (as exact measurements have proven) and an intrusion of foreign matter is impossible. If, however, the material has been indifferently mixed and not properly condensed, it contains loose particles of powder that have not been compounded, and spaces which, in mixing, being pressed into the tough mass, are filled with air. The enamel is porous and liable to absorb foreign matter. To avoid this, mix quickly, incorporating all powder possible, until the mass curls from the slab when the flat side of the spatula is run lightly over it; then thoroughly mix with heavy spatulation to force out the air particles. Introduce under heavy pressure, for the same reason. If the pulp is nearly exposed, use cavity lining to avoid strangulation. As long as the material is plastic, everything coming in contact with it must be non-metallic and absolutely clean.

Second—If the surface of the filling is rough or poor margins exist, foreign pigments, which change the color of the whole tooth by deposits, will influence the surface and boundaries. The deposits of the pigments on a rough surface are much more intense and stay considerably longer. The roughness is caused by using coarse strips and discs, by insufficient polishing, and by destroying the upper surface in cases where the filling is exposed to the saliva too soon. To avoid this, construct an exact and nicely finished

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

margin. The filling must not come below the margin of the cavity. A very smooth, highly polished surface must be obtained, and there must be sufficiently long protection against saliva, so much more the thinner the enamel was mixed. Stir liquid thoroughly each time, discard residue of bottle, and keep rubber dam on for at least twenty minutes.

Third—The enamel in itself contains no substances which through any reaction could produce any pigment. It does contain pigments usually found in all silicates and other cements, and these are, of course, sensible to certain influences. Sulphuretted hydrogen and products of reduction can be observed as causes of darkening. But the forming of sulphuretted hydrogen and products of reduction are hardly possible, and one can scarcely attach much importance to them. Should they appear, however, they could only cause a superficial discoloration—"a slight indication"—which may be easily removed by a toothbrush or, eventually, by a little tooth powder. In this case a deeper or stronger discoloration is impossible.

In the darkening of lingual fillings one thing must be observed. Discoloration of the surface in consequence of roughness is more liable here, as the lingual side of the teeth cannot be kept clean. In addition, in a mirror a filling always appears considerably darker on account of the optical difference of the tooth substance.

AMALGAM CEMENT.

Freshly mixed amalgam and oxyphosphate of zinc cement, mixed to a thick creamy consistency, about equal parts, are thoroughly incorporated and inserted into the cavity.

OXYPHOSPHATE OF ALUMINUM.

Powder.

Aluminum powder	40 parts
Oxyphosphate of zinc cement powder .	60 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid.

Oxyphosphate of zinc cement liquid.

OXYPHOSPHATE OF COPPER.

Powder.

Black oxide of copper	50 parts
Oxyphosphate of zinc cement powder	50 “

Liquid.

Oxyphosphate of zinc cement liquid.

OXYPHOSPHATE OF GOLD.

Powder.

Precipitated gold powder	2 parts
Oxyphosphate of zinc cement powder	1 part

Liquid.

Oxyphosphate of zinc cement liquid.

OXYPHOSPHATE OF SILVER.

1.—Powder.

Silver chloride	2 parts
Oxyphosphate of zinc cement powder	98 “

Liquid.

Oxyphosphate of zinc cement liquid.

2.—Powder.

Silver phosphate	2 parts
Oxyphosphate of zinc cement powder	98 “

Liquid.

Oxyphosphate of zinc cement liquid.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

OXYSULPHATE OF ZINC CEMENT

(Artificial Dentine.)

Powder.

Powdered gum mastic	$7\frac{1}{2}$ parts
Calcined zinc oxide	100 “
Calcined zinc sulphate	12 “

Liquid.

Gum arabic	25 parts
Water	65 “
Alcohol	10 “
Liquid phenol	$\frac{1}{5}$ part

OXYCHLORIDE OF ZINC CEMENT.

1.

Powder.

Zinc sulphate, exsiccated	1 part
Zinc oxide	3 parts

Mix and calcine in a sand crucible at a red heat for about ten minutes; remove, powder, and bolt through fine cheesecloth. Keep in well-stoppered bottles.

Liquid.

Zinc chloride	50 parts
Water	25 “

Let stand for twenty-four hours and filter.

2.

Powder.

Powdered white glass	3 parts
Zinc oxide, calcined	9 “

Liquid.

Borax	$\frac{1}{2}$ part
Zinc chloride	20 parts
Hot water	6 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

OXYCHLORIDE OF MAGNESIUM CEMENT.

(Sorel's Magnesia Cement.)

Powder.

Magnesium oxide, heavy	10 parts

Liquid.

Magnesium chloride, saturated solution	10 parts

TIN CEMENT.

Powder.

Sponge-tin powder (see page 162)	1 part
Oxyphosphate of zinc cement powder	1 “

Liquid.

Oxyphosphate of zinc cement liquid.

GUTTA-PERCHA CEMENT FOR SETTING CROWNS, BRIDGES, ETC.

Aristol	10 parts
Oil of eucalyptus	30 “
Chloroform	30 “

Pink base plate gutta-percha, enough to make a stiff paste.

CEMENT FOR REPAIRING CELLULOID.

The broken surfaces are brushed with a mixture of 3 parts alcohol and 4 parts ether, and as soon as the celluloid has softened the pieces are firmly pressed together. Instead of the alcohol-ether mixture the following solution may be employed:

1.

Gum camphor	1 part
Gum shellac	5 parts
Alcohol	20 “

2.

Celluloid	1 part
Acetone	20 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

RUBBER CEMENT FOR DENTAL BASE PLATES.

1.

Caoutchouc	10 parts

Carbon disulphide, enough to make a thick fluid.
Keep in well-stoppered bottles.

2.

Unvulcanized dental rubber	10 parts

Chloroform, enough to make a thick fluid.

PULP CAPPING VARNISHES.

1.

Phenol, crystals	1 part
Collodion	10 parts
Yellow rosin	10 “
Ether	40 “

2.

Gum mastic	2 parts
Balsam of Peru	2 “
Chloroform	6 “

CAVITY VARNISHES.

1.

Select gum copal	50 parts
Ether	50 “
Betanaphthol	5 “
Dissolve, filter through a well-covered filter, and add enough ether to make the whole measure	75 “

2.

Gum damar	1 part
Rosin, light-colored	6 parts
Ether	4 “
Alcohol	4 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Gum camphor	6 parts
Gum copal	25 "
Ether	50 "

4.

Gum copal	2 parts
Acetone	3 "

5.

Celluloid	1 part
Acetone	10 parts
Amyl acetate	15 "

6.—Carbolized Rosin.

Rosin	4 parts
Phenol crystals	4 "
Chloroform	3 "

7.—Zapon Varnish.

Celluloid	2 parts
Gum camphor	1 part
Ether	30 parts
Alcohol	70 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER IV.

HARD AND FUSIBLE ALLOYS, SOLDERS, FLUXES AND AMALGAMS; REFINING OF PRECIOUS METALS; TEMPERING OF METALS; METAL POLISHES; ETC.

ALLOYING OF GOLD PLATE OF VARIOUS CARATS.

After William H. Dorrance.

Pure gold may be alloyed for dental purposes with an alloy consisting of:

Pure silver	40 parts
Pure copper	60 "

according to the following equation:

$$\frac{\text{Present weight} \times \text{present carat}}{\text{Required carat}} = \text{whole mass;}$$

or, in figures, for making 18-carat gold.

$$\frac{100 \text{ parts} \times 24 \text{ carats}}{18 \text{ carats}} = 18)2400 = 133\tfrac{1}{3} \text{ parts} = \begin{array}{l} 100 \;\; \text{parts pure gold} \\ \;\;20 \;\; \text{parts pure copper } (60\ \%) \\ \;\;13\tfrac{1}{3} \text{ parts pure silver } (40\%) \\ \hline 133\tfrac{1}{3} \text{ parts} = \text{whole mass.} \end{array}$$

COIN GOLD.

An American ten-dollar goldpiece weighs 258 grains and is 21.6-carat fine. It consists of:

Pure gold	90 parts
Pure copper	9 "
Pure silver	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dental gold of various carats may be made as follows, according to the above formula:

18-Carat Gold Plate.

Coin gold	100 parts
Pure copper	9 “
Pure silver	11 “

19-Carat Gold Plate.

Coin gold	100 parts
Pure copper	$5\frac{1}{4}$ “
Pure silver	$8\frac{1}{2}$ “

20-Carat Gold Plate.

Coin gold	100 parts
Pure copper	$1\frac{4}{5}$ “
Pure silver	$6\frac{1}{5}$ “

22-Carat Gold Plate.

Coin gold	100 parts
Pure gold	75 “
Pure silver	5 “

GOLD ALLOYS.

14-Carats.

	Yellow.	Pale red.	Red.
Pure gold	14 parts	14 parts	14 parts
Pure silver	6 “	3 “	1 part
Pure copper	4 “	7 “	9 parts

16-Carats.

	Yellow.	Red.
Pure gold	16 parts	16 parts
Pure silver	$4\frac{2}{3}$ “	$1\frac{2}{5}$ “
Pure copper	$3\frac{1}{3}$ “	$6\frac{3}{5}$ “

18-Carats.

	Yellow.	Red.
Pure gold	18 parts	18 parts
Pure silver	$3\frac{1}{2}$ “	$2\frac{1}{2}$ “
Pure copper	$2\frac{1}{2}$ “	$3\frac{1}{2}$ “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

20-Carats.

Pure gold	20	parts
Pure silver	2	“
Pure copper	2	“

GOLD PLATE.

Weinstein.

1.

Gold	88	parts
Platinum	7½	“
Palladium	2½	“
Silver	2	“

Melting point 2075° F.

2.

Gold	84½	parts
Platinum	8½	“
Palladium	2	“
Silver	½	“
Copper	4½	“

Melting point 1975° F.

CAST GOLD.

Weinstein.

1.

Gold	80	parts
Platinum	9½	“
Palladium	2½	“
Silver	1	part
Copper	7	parts

Melting point 1975° F.

2.

Pure gold	450	parts
Pure platinum	25	“

GOLD PLATE FOR SEAMLESS CROWNS.

Evans.

Coin gold	5	parts
Pure gold	13½	“
Pure silver	1½	“

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CROWN GOLD.

Evans.

Coin gold	5 parts
Pure gold	9 “
Pure silver	1 part

CLASP METAL.

1.—Evans.

Pure gold	10 parts
Copper	2 “
Silver	1 part
Platinum	1 “

2.—Weinstein.

Gold	63 parts
Silver	17 “
Copper	7 “
Platinum	13 “

SUBSTITUTES FOR GOLD.

1.

Copper	11.71 parts
Platinum	2.40 “
Silver	3.53 “

2.

Zinc	1 part
Copper	7 parts
Platinum	16 “

SILVER COIN ALLOY.

Pure silver	9 parts
Pure copper	1 part

ALLOYS FOR CHEOPLASTIC CASTINGS.

1.—Lower Denture Alloy.

Gold	1 part
Silver	2 parts
Tin	20 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.—Samsioe's Alloy.

Platinum	3½ parts
Gold	2½ “
Silver	29 “
Tin	65 “

3.—Watt's or Weston's Alloy.

Silver	1 part
Tin	5 parts

ALUMINUM ALLOY.

1.

Silver	5 parts
Aluminum	95 “

(*Note.*—Aluminum base plates should not be invested in plaster of Paris which has been mixed with salt water. Sodium chloride in the presence of organic or inorganic acids will destroy aluminum.)

2.

Copper	1 part
Silver	6 parts
Aluminum	93 “

ALUMINUM BRONZE.

Copper	90 parts
Aluminum	10 “

This alloy is used as a substitute for low-carat gold plate; it is extensively employed in the manufacture of regulating appliances. It possesses a color similar to gold, is tenacious, ductile and malleable, and melts at about 1800° F. It may be soldered with 16 to 18-carat gold solder. Clasps may be made from this alloy; they should be thoroughly annealed and very slowly cooled, so as to retain a strong spring temper.

DENTAL ALLOY.

Platinum	1 part
Silver	4 to 5 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

It melts at about 1800° F. It is soft and pliable and in many respects superior to pure silver. Dental rubber may be vulcanized to dental alloy without destroying its integrity. It may be soldered with 18-carat gold solder or with silver solder.

MAGNALIUM.

An alloy of aluminum with 10 to 15 per cent of magnesium, having a specific gravity 2.4 to 2.6 It has a silver-white color, is tenacious and ductile, and is recommended as a superior substitute for aluminum intended for plate work. Magnalium plate, No. 20 gauge, has a tensile strength of about 30,000 pounds per square inch. Magnalium resists oxidation more readily than aluminum, and is almost unaffected by dry or damp air, water, gaseous ammonia, carbon dioxide, sulphuretted hydrogen, and most organic acids. The thermal conductivity of magnalium is much greater than that of aluminum.

VICTORIA METAL.

An alloy composed of copper, nickel and zinc. It is in many respects equal to aluminum bronze, but softer, and possesses no elasticity.

SPONGE-TIN.

Scheurer.

A solution of pure stannic chloride is precipitated with pure zinc, and the resultant sponge-tin is thoroughly washed in boiling water, until free from all acidity, and dried in a drying-room. The sponge-tin appears as a gray felt, consisting partly of light, dust-like tin particles, partly of metallic fibers and scales. It is used for filling teeth much like moss-fiber gold. Pluggers as used for sponge-gold are advised for making fillings.

COMMERCIAL ALLOYS.

Cosmos Alloy.

Copper	68.77 parts
Zinc	30.14 "
Lead	1.09 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Randolf's Alloy.

Copper	60.2	parts
Zinc	38.8	"
Lead	0.34	part

Ruoltz's Alloy.

Silver	20	parts
Copper	50	"
Nickel	30	"

Reetz's Alloy.

Copper	15	parts
Tin	2.34	"
Lead	1.82	"
Antimony	1	part

Stellite Alloy.

The manufacturers claim that "stellite is a newly discovered alloy of cobalt, chromium, and semi-rare metals. It resists oxidation better than any known metal except gold and platinum."

LOW FUSION ALLOYS.

	Antimony.	Lead.	Tin.	Cadmium.	Bismuth.	Melting point deg. F.
Brophy's	0	$2\frac{3}{4}$	$2\frac{1}{2}$	0	3	240
Berry's	4	10	16	0	16	
Crouse's	0	5	5	1	8	190
Erman's	0	1	1	0	2	199
Harper's	0	4	4	1	7	180
Hodgen's	2	5	3	0	8	244
Melotte's	0	3	5	0	8	205
Merck's	0	25	25	20	55	162
Molyneau's	0	3	2	2	5	140
Newton's	0	2	3	0	5	212
Richmond's:						
1	0	5	3	0	8	202
2	0	19	20	13	48	
Rose's	0	8	3	0	8	203
Simpson's	0	19	20	13	48	
Wood's:						
1	0	4	2	1	7	158
2	0	20	40	26	96	135

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Note.—The metals have to be melted according to the above arrangement, *i. e.*, melt the antimony first, when completely fused, add the lead, then the tin, then the cadmium and finally, under constant stirring (with a low flame) the bismuth.

LOW FUSING ALLOYS FOR VALVE PLUGS.

Lead.	Tin.	Bismuth.	Melting point. deg. F.
125	125	75	212
100	100	100	257
200	200	100	288
280	300	50	311
200	240	50	335
300	200	50	347
100	100	0	370

DIE- AND COUNTER-DIE METALS.

Die Metals.

	Copper.	Antimony.	Zinc.	Tin.
1	3	0	39	8
2	6	3	48	10
3.	0	0	50	50
4. (Haskell's) . .	1	2	0	8

Counter-die Metals.

	Lead.	Tin.	Bismuth.
1.	4	1	0
2.	3	1	2
3. (Haskell's) . .	5	1	0

CARBON COATING FOR METAL DIES.

Rosin	1 part
Oil of turpentine	3 parts

Dissolve and keep in a well-stoppered bottle.
Paint the solution over the die and burn it off.

BABBITT METAL.

Haskell.

This is the only metal having all the fine requirements for a dental die, which are: (1) Non-shrinkage; (2) hardness, so as not to batter; (3) toughness, so as not to break; (4)

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

a smooth surface; (5) melting at a low temperature. The proper formula is copper, 1 part, antimony, 2 parts; tin, 8 parts; melting in the order named. Do not overheat, as it will oxidize the tin.

SPENCE METAL.

Sulphur	4 parts
Iron sulphide	3 "
Lead sulphide	3 "
Zinc sulphide	3 "

Melt the sulphur in an earthenware pot and stir in the sulphides in very fine powder. Spence metal melts at about 320° F.; it is very hard and expands slightly on cooling. It gives sharp casts and may be poured into oiled plaster-of-Paris impressions. It is largely used as a die metal in the dental laboratories of England and on the European continent.

SOLDERS.

Gold Solder Alloy; Dorrance.

Pure silver	1 part
Pure zinc	2 parts
Pure copper	3 "

The silver and copper are melted together in a sand or graphite crucible lined with borax; the zinc, wrapped in tissue paper to prevent oxidation, is quickly thrust into the molten mass and the whole is stirred together with a clay-pipe stem held in a pair of tongs. To prepare solder, melt 1 part of this alloy with 6 to 7 parts of clippings of the gold plate under construction.

GOLD SOLDERS.

1.

	For: 14-carat gold.	16-carat gold.	18-carat gold.	20-carat gold.
Coin gold	13	15	17	19
Silver	7	5	4	4
Copper	3	3	2	2
Brass pins	1	1	1	1

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Melt together from 5 to 7 parts of scraps of the gold plate under construction with 1 part of English brass pins.[1]

3.—Low Fusing.

14-carat gold solder	1 part
Silver solder	1 "

4.—Made from Coin Gold.

For 20-carat Gold Plate.

$5.00 gold piece
16 grains cadmium.

For 18-carat Gold Plate.

$5.00 gold piece
16 grains copper
16 grains cadmium.

For 14-carat Gold Plate.

$5.00 gold piece
16 grains silver
48 grains copper
16 grains cadmium.

5.—Zinc Type.

	For: 14-carat gold.	18-carat gold.	20-carat gold.	22-carat gold.
Pure gold	50	65.5	73.7	82.5
Pure silver	26	19.0	12.0	8.0
Pure copper	18	10.0	9.1	4.3

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[1] English brass pins, which may be obtained at a Notion Store furnish a good quality of brass for such purposes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

6.—Zinc-Cadmium Type.

	For: 14-carat gold.	16-carat gold.	18-carat gold.	20-carat gold.
Pure gold	57.5	65.0	74.0	82.3
Pure silver	13.0	9.5	6.5	3.8
Pure copper	22.0	18.0	12.0	8.3
Pure zinc	1.8	1.8	1.8	1.8
Pure cadmium	12.0	10.5	10.0	8.5

7.—Peeso.

20-carat.

Coin gold	48 parts
Nay's 18-carat gold solder	30 "
Copper	6 "

21-carat.

Coin gold	50 parts
Peeso's 20-carat gold solder	50 "

PLATINUM SOLDER.

Platinum	25 parts
Gold	75 "

IRIDIO-PLATINUM SOLDER.

1.

Use platinum solder.

2.

Watt's crystal gold and platinum make an easy flowing 10 per cent platinum solder for uniting the framework in inlay, crown, bridge or continuous gum work. It flows almost as easily as pure gold. It should be used with a flux.

SILVER SOLDERS.

1.

Pure silver	6 parts
Pure copper	3 "
Pure zinc	1 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Coin silver	90 parts
Zinc	10 "

3.

Pure silver	12 parts
Brass (English brass pins)	6 "

SOLDER FOR NICKEL OR GERMAN SILVER.

Use silver solder.

ALUMINUM SOLDER.

(Monrey.)

	1	2	3
Tin	80	85	88
Copper	8	6	5
Aluminum	12	9	7

SOFT SOLDERS.

Tin.	Lead.	Bismuth.	Melting point deg. F.
1	25	..	560
1	10	..	542
1	5	..	512
1	3	..	480
1	2	..	435
1	1	..	370
2	3	..	
1½	1	..	335
2	1	..	340
3	2	..	334
3	1	..	356
4	1	..	365
5	1	..	378
6	1	..	381
4	4	1	320
3	3	1	279
2	2	1	288
1	2	2	228
5	3	3	201

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

SOLDER FOR ATTACHING METAL TO GLASS, PORCELAIN, ETC.

Bismuth	1 part
Lead	6 parts
Antimony	9 "

The alloy expands on cooling, hence its usefulness as a "solder" to attach metal to glass, porcelain, etc.

FLUXES FOR HARD SOLDERING.

1.

Calcined borax (borax glass)	1 part
Yellow vaseline	2 parts

2.

Borax	240 parts
Boric acid	240 "
Ammonium chloride	12 "
Potassium carbonate	5 "
Hot water	2000 "

3.—Weinstein.

Borax glass, fused	55 parts
Boric acid, not fused	35 "
Silica	10 "

Place in a clean sand crucible, and bring to a fair red heat. When fluid, pour the mixture into cold water. Remove from the water as soon as possible, dry, pulverize, and pass through a fine sieve.

4.—Dodel.

Borax	7 parts
Boric acid	7 "
Distilled cold water	50 "

Shake, until dissolved.

5.

Calcined borax (borax glass)	4 parts
Calcined sodium chloride	3 "
Calcined potassium carbonate	2 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

6.

Calcined borax (borax glass)	7 parts
Ammonium chloride	1 part

7.

Phosphoric acid, U. S. P.	5 parts
Water	5 “
Alcohol	5 “

TO TEASE SOLDER.

A common slate pencil is better for teasing solder than an instrument. The solder does not adhere to it and it does not heat up and burn the fingers. It can also be used for stirring fusible alloys. Small crevices, holes, etc., may be easily covered with solder by first filling these cavities with sponge-gold.

FLUXES FOR SOFT SOLDERING.

1.

Dental cement liquid (phosphoric acid)	1 part
Alcohol	1 “

2.

Zinc	5 parts
Hydrochloric acid	10 “

Dissolve, and, after reaction has ceased, add

Ammonium chloride	3 parts
Water	10 “

3.

Pieces of zinc are dissolved in hydrochloric acid until the acid is saturated. The resultant solution of zinc chloride is mixed with an equal amount of a mixture of equal parts of ammonia water and alcohol. After standing a few days the solution is filtered and is then ready for use.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4.

Zinc chloride	2 parts
Water	4 “
Alcohol	4 “

5.

Rosin	45 parts
Suet	45 “

Melt, and add, with constant stirring

Ammonium chloride	10 parts

FLUX FOR SOLDERING ALUMINUM.

Stearic acid	80 parts
Zinc chloride	10 “
Tin chloride	10 “

SOLDER FOR REPAIRING BROKEN METAL, FINE INSTRUMENTS, ETC., WHEN HEAT WOULD BE INJURIOUS.

(Cold Solder.)

Solder:

Tin	10 parts
Silver	8 “
Bismuth	1 part
Platinum	1 “

Melt together, cast in an ingot and rasp to filings. Mix filings, 3 parts, and flux, 1 part, to a smooth paste when about to use. Omitting the bismuth gives a granular mass suitable for filling crevices; omitting the platinum reduces the strength and requires an hour to harden.

Flux:

Metallic sodium	1 part
Mercury	50 parts

Keep in glass-stoppered bottle.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

THE MANUFACTURE OF DENTAL AMALGAM ALLOYS.

N. K. Garhart.

The metal formulas of all dental amalgam alloys that are usually found on the market are composed of two or more of the following four metals: Silver, tin, copper and zinc. Silver, tin and copper are the metals most commonly used, although zinc in conjunction with these three is becoming more frequently used. Gold and platinum are not used to any appreciable extent. Only minute traces of these metals can be found in the so-called gold and platina alloys. It is not the expense of making the alloy that concerns the average manufacturer, but the expense of marketing his products precludes the use of such expensive metals. Simple silver and tin formulas are rarely used nowadays. The test of time has proven that such simple formulas make very poor alloys. Copper and zinc have an effect of controlling the shrinking factor of an alloy, also hastening its setting properties. That copper toughens and increases the edge-strength has been known for many years. It also is well known that it causes discoloration when present in large quantities. Aluminum, bismuth and antimony have been exploited for the purpose of adding some special virtue to alloys. I must admit that I have never found any advantages in using any of these metals. Alloys containing appreciable amounts of bismuth and antimony discolor the hand to an unusual degree while aluminum can never be used in quantities beyond 1 per cent. If larger amounts of aluminum are used the amalgam will suddenly decompose, setting free the mercury and converting the other metals to oxides. Various forms of bronze have been suggested for imparting a beneficial action to alloys. My observation and experience has been that such beneficial results are mainly due to copper, which constitutes about 80 to 90 per cent of the bronze. Most amalgam authorities claim that silver is the expanding element and tin the contracting element of all amalgamating alloys. Hereinafter my experiments will prove that this is not altogether true.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

We have heard a great deal of discussion in regard to the so-called white alloys, and the question is daily asked us if our alloy will maintain its color indefinitely in the mouth. Since I believe that the discussion of color should come under the head of formulas, I propose to dispose of this matter now. Amalgams either oxidize or sulphidize in the mouth. I actually believe that most of the discoloration is due to oxidation. We all know that any form of gold under 18k will rapidly discolor in the mouth; hence if it requires pure gold from 80 to 90 per cent fine to prevent discoloration, why should it not require the same amount of gold to prevent amalgam from discoloring? You will readily appreciate the fact that it is impossible to use such a high percentage of gold, and experience has proven that even 15 per cent of gold will not prevent discoloration in amalgam fillings. Of course manufacturers say that they make alloys that will not discolor, but you may believe as much of this story as you wish. We know that some alloys discolor more easily than others. You can always attribute this cause to the presence of too much tin or copper and sometimes both metals. The reason why a great many alloy fillings retain their bright color in the mouth is due to the constant polishing that they receive from the mastication of food. You cannot attribute the retention of color to any other cause, inasmuch as minute quantities of other metals and special methods of preparing the alloy will not protect the amalgam from discoloring. In chemistry we have certain fixed and immutable laws which are beyond the control of man.

It is common belief that the smelting of alloys is a simple procedure. All that is required is a crucible, the metals, some borax and a furnace in which we are to liquify the metals with heat. To the competent metallurgist the proper smelting of alloys is not a difficult proceeding. That it requires technic and skill is perfectly true. Not all formulas are melted alike; hence a full knowledge of the chemistry of metals is required. Most metals have a great affinity

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for oxygen when in a molten state, and some of them are volatile at certain temperatures. To preserve the integrity of the formulas so that loss due to volatilization and liquation, or separation of the metals will not occur during the smelting and pouring process are a few of the important features to which the metallurgist must give careful attention. In regard to the furnace work I will say that the gas and air must be under perfect control. This requires the use of delicate regulators. Both gas and air should be under pressure and so proportionately mixed as to always maintain a deoxidizing atmosphere in the furnace. Powdered carbon as a preventative for oxidation is far preferable to borax. If by any accident some of the molten mass should oxidize, borax will dissolve the oxides, while carbon will reduce them to the metallic state. Carbon has a greater affinity for oxygen than that possessed by any of the metals most commonly used for amalgam purposes. It is quite necessary that the metals must be treated in the furnace for some time so that their chemical union may be completed. Graphite crucibles are most generally used for holding the metals. The use of crucible covers is necessary for preventing oxidation during the smelting process. Simply liquefying the metals, stirring and pouring them will not produce a homogenous product. The use of iron rods for stirring should be abandoned, and compressed carbon rods substituted in their place. Molten alloy will dissolve iron, and it will also attack the ingot mould, which is usually made from cast iron. The ingot moulds should be covered with a thin film of carbon, which is readily accomplished by smoking it over a coal-oil flame. I have always considered it a wise policy to smelt each ingot separately, and so have my furnaces designed to hold a number of small crucibles.

The cutting process is the method employed for reducing the ingot to a fine state of division, so that the alloy will readily combine with mercury. This process is one of the most important branches of this industry. Most makers cut or shave their alloys on an ordinary lathe. The lathe

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tool is usually fed by hand. The self-feeding mechanism of an ordinary lathe is entirely too coarse for this purpose. Several years ago I abandoned the hand process of cutting alloys, and had designed for my use a special automatic tool-feeding mechanism.

The filing process is not a scientific way of cutting alloys. The filings are not uniform and there is no method for sharpening the file. A cylindrical file is generally used, and because of their great expense they are used until they are well worn out. When the file is new small particles of steel break off with the alloy. These steel particles must be carefully removed with the aid of an electro-magnet. It requires but a short time for the file to become dull; hence the alloy thereafter is torn off by friction. Since heat is a product of friction, it is very apparent that filings take up oxygen from the atmosphere.

The shaving method requires the use of keen-edged tools, and is by far the most scientific way to cut alloys. The tools are sharpened from time to time, thereby producing a clean and even cut. The finest grade of steel is employed and they are carefully tempered to the required degree of hardness, in keeping with the character of alloy to be cut. Alloys containing large quantities of copper and silver are very brittle. The quick-setting alloys are so brittle that they are very difficult to shave. They are usually cut in the form of a needle-like shaving. In this state they combine more readily with mercury than when they are in a flake-like form.

The failure of a manufacturer to imitate another's product is not due to the formula, but to the cutting process. Chemical analyses will reveal the exact metal formula of any alloy. It is not the formula but the exact method of cutting that bothers imitators. So it will be observed that the personality of the alloy can be readily changed by the cutting process. We may take two alloys of the same formulas, one cut in thin shavings, and the other in thick ones. They will mix and set so differently that the

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average practitioner would conclude that they were widely different from each other in formula. It is this variation in the thickness of the shavings that has a wonderful influence upon shrinkage, expansion, edge-strength and setting factors of an alloy. The hand method of feeding the tool in cutting alloys will always produce an ununiform product. Amalgams made from such alloys will always show variable results in the mouth.

The annealing process is the means employed by various manufacturers for artificially aging their alloys. Dr. Black advanced the idea of heating fresh cut alloys for several days at a temperature of 120° F. Other investigators have since shortened the length of time required for artificially aging by using boiling water. The various makers of quick-setting alloys claim that their products will not change from further aging. These claims are distinctly false and misleading. All quick-setting alloys will set slower after they have stood in your office for one year. These alloys are only partly annealed and very slightly so at that. Any quick-setting alloy can be annealed so as to be extremely slow-setting if subjected to the boiling water process for a considerable length of time. Fresh quick-setting alloys when properly cut possess several points of expansion. The annealing process will remove this expansion; hence they are treated until they only show from ½ to 1 point of expansion. So you will note that quick-setting alloys are only partly annealed, and they will change when left in your office for any length of time.

The manufacturer is in a better position to judge of the merits of alloys than the average dentist. He has the entire clinical experience of his trade to rely upon and he gains much valuable information from his competitor's trade as well. The old saying that "two heads are better than one" aptly applies to this case.

The question of testing alloys is one which has concerned the dental profession ever since amalgams first came into practical use. The results that I have obtained from

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using the micrometer have led me to believe that it is the only reliable and accurate means for determining the preserving properties of amalgam fillings. I do not wish to ignore the "test of time," nor do I care to ignore the great number of cases of faulty manipulation upon which a great number of these tests have been unconsciously based. As far as the accuracy of the micrometer is concerned, it has proven conclusively that alloys which show the best results on this instrument always give the best results in the mouth. It records every particle of shrinkage and expansion with great delicacy and accuracy. Fillings made from slightly expanding quick-setting alloys will not fail in the mouth. Should a failure happen you can safely attribute the cause to faulty manipulation, or preparation of the cavity, or else to a condition of the tooth structure, which must be of such a degenerate character that it could not be saved by any artificial means.

According to my estimation the glass tube test is a very unreliable and inaccurate method for ascertaining the tooth-preserving qualities of amalgam. The walls of any artificial matrix should compare favorably with those of the dentine. The walls of the tooth are left rough by the action of the bur, and thus afford an ideal surface for an amalgam or a crystalline compound to adhere. Amalgams are nothing more than metal cements, of which the copper and the silver are the hardening agents. Take any cement which does not leave a polished surface and it will not adhere to a polished surface like that of glass. Portland and lime cements will not adhere to glass, but when applied to any roughened material like brick the adhesion is complete. The greatest obstacle in the way of properly filling a glass tube with amalgam is the removal of excess mercury. There is no mechanical method for securing the tube so that the proper pressure can be applied to condense the filling in place. Only a downward pressure can be exerted which forces the mercury to the inner walls of the tube. This surplus mercury is reabsorbed again after your work has been completed,

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thereby, producing shrinkage, especially at the periphery of the filling. Lateral pressure is necessary to force the dry amalgam to the periphery of the filling. The existence of these grave faults in using this test no operator can deny. I consider any test unreliable that cannot be duplicated with some degree of accuracy. It is impossible to fill six tubes with the same make of alloy and obtain the same results in all cases.

I firmly believe in the microscope for examining margins. The best plan is to photograph your work from month to month. These photographs are your records of any changes that might have occurred.

The flow and the crushing tests of alloys are of no practical importance, inasmuch as these factors are amply great enough in all alloys. It is an easy matter to make a poor alloy with a good edge strength. Spheroiding or changing of form is nothing more than excessive shrinkage. This condition of affairs can be directly attributed to faulty manipulation of the alloy. Dr. Black could have given some valuable information on this subject had he submitted some spheroidal fillings to a chemical analysis. Had the quantity of mercury been estimated, he could have proven the presence of surplus mercury. An alloy containing as low as 45 per cent silver when properly manipulated and inserted in the cavity will not flow to an appreciable degree. Nearly every high grade alloy will stand any strain that masticating stress can impose upon it.

Dr. Black deserves great credit for presenting the practical utility of the micrometer to us. It certainly fills a long-felt want, and affords a scientific means for standardizing our products without relying upon the conflicting data that we are in the habit of receiving from our trade. I have compiled some important tests which will throw some light upon the subject of alloys. Before presenting these tests to you I desire to call your attention to some conclusions of Dr. Black's work. He stated that it was impossible for the manufacturer to produce an alloy which would give uniform

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results from any set formula. At the time that he made these statements there was a great deal of truth in his remarks, and it was that which led me to take up this work of investigation. It occurred to me that we should look for some fault in our smelting, annealing or cutting processes as being the probable cause of variation in our finished product. My theory has been, if like conditions prevailed throughout the entire process of making alloys that like results would always be obtained. I will afterwards prove that this fault was mainly due to a variation in the thickness of cut, as a result of using the hand process of cutting our alloys. This variation in the thickness of cut produced a like variation in the shrinking and expanding factors of the resulting amalgam. It was for this reason alone that I adopted the use of a special automatic machine for cutting my alloys.

There is one more thing that Dr. Black stated which did not seem practical to me. He claimed that filed alloys gave better results than the shaved variety. He never presented a scientific explanation of this assertion. Had he carried his investigations further he would have found that filed alloys are coarse cut products, while the shaved alloys were invariably cut very thin at the time that he made his experiments. When he was carrying on these experiments, the various makers of alloys were in the habit of cutting their alloys in extremely thin shavings, which were very popular with their trade. Had alloys been cut in much thicker shavings there would have been no difference in his results.

Having called your attention to these important facts we will carefully compare the results of my tests of various formulas with them. Each formula was annealed for fifteen minutes in boiling water, and they were cut in four different thicknesses of shavings. No. 1 cut is the thinnest. The others are progressively 25 per cent thicker. The test plugs of amalgam measured $\frac{1}{4}$ inch in diameter and $\frac{1}{4}$ inch in depth. They weighed 2.3 grammes, or about 35.5 grains.

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The fillings were inserted in a hardened steel matrix or tube. The alloy was carefully weighed and mixed with an exact quantity of mercury sufficient to produce a stiff plastic mass. The usual precautions were taken in regard to wafering the amalgam, and these tests were made under the same conditions, so far as it was within my power to accomplish it. Each sample was subjected to a twenty-four-hour test, and usually after the sixth hour no further movement could be detected.

FORMULA NO. 1.

Silver 45, copper 10, tin 45 per cent.
Shrinkage, cut 1—9.5
2—7.5
3—6.5
4—4.5 points

No. 1 required equal parts of mercury and alloy; No. 2, 1.4 parts mercury to 1.5 parts alloy; No. 3, 1.3 parts mercury to 1.5 parts alloy; No. 4, 1.2 parts of mercury to 1.5 parts of alloy.

FORMULA NO. 2.

Silver 50, tin 45, copper 5 per cent.
Shrinkage, cut 1—14.5
2—11.5
3—7.5
4—6.0 points

Proportions of mercury and alloy required were the same as in formula No. 1.

FORMULA NO. 3.

Silver 55, tin 40, copper 5 per cent.
Shrinkage, cut 1—11.5
2—10.5
3— 7.0
4— 5.0

Proportions of mercury and alloy same as in No. 1 formula.

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FORMULA NO. 4.

Silver 60, tin 38, copper 1, zinc 1 per cent.
Shrinkage, cut 1—8.5
2—7.0
3—5.5
4—3.0

Proportions of mercury and alloy used same as in No. 1 formula.

FORMULA NO. 5.

Silver 68, tin 32 per cent
Shrinkage, cut 1—12.0
2—10.5
3— 8.0
4— 4.5

Portions of alloy and mercury used were 5 of alloy and 6 of mercury for 1 and 2, equal parts for 3 and 4.

FORMULA NO. 6.

Silver, 68, tin 28, copper 2.5, zinc 1.5 per cent.
Shrinkage, cut 1—3.5
2—2.0
Expansion 3— .5
4—1.5 Points

Proportions of mercury, 7 of mercury and 5 of alloy for 1 and 2; 6 of mercury and 5 of alloy for 3 and 4.

FORMULA NO. 7.

Silver 60, tin 35, copper 5 per cent.

Only No. 4 cut measured. Shrinkage 3.5 points. Mercury 1.2 to 1.5 of alloy.

We will see what these tests prove in regard to formulas. Your attention is called to the various cuts of No. 1 formula. Carefully compare these shrinking factors with those of Nos.

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2, 3 and 5. You will note that the shrinking factors are much less in No. 1 formula than in Nos. 2, 3 and 5. The silver factor of Nos. 2, 3 and 5 formulas is much higher than that of No. 1, and yet the former alloys show a greater percentage of shrinkage. The shrinkage factors are greater with one exception, and that is the No. 4 cut of No. 5 formula. If silver is the expanding element, and tin the contracting element, then formulas 2, 3 and 5 should show the best results. Your attention is next called to the percentage of copper in Nos. 2 and 3 formulas. It will be seen that it is just 50 per cent less than the amount contained in No. 1 formula. It is quite evident that copper overcomes shrinkage to a wonderful degree. While silver possesses this property, it may be regarded that the combination of the two metals are the elements of an alloy. Let us compare the shrinking factor of No. 4 cut of formula No. 1 with that of No. 4 cut of formula No. 7. The results show us that there is one point in favor of No. 7. The percentage of copper is 50 per cent less in No. 7 than in No. 1. The silver required to overcome this reduction is three times that of the copper, or just 15 per cent. These results prove to us that the expanding influence of the copper is much greater than that of the silver. Your attention is called to No. 5 formula. Please note the very high percentage of silver that it contains. This formula contains no copper in its composition. It carries just 23 per cent more silver than No. 1 formula. A careful comparison of the shrinking factors of the No. 5 formula with that of No. 1, and including the shrinking and expanding factors of formula No. 6, will prove conclusively that simple tin and silver combinations are the worst formulas that any manufacturer can use. We will now compare the shrinkage factor of No. 4 cut of formula No. 7 with that of No. 4 cut of formula No. 4. It will be seen that the results are slightly more favorable for the No. 4 formula than for the No. 7. You will particularly note that No. 4 formula only contains 1 per cent each of copper and zinc, while No. 7 formula contains fully 5 per cent copper. Summing up these results we are led to believe that a four-metal

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formula is the best that any manufacturer can adopt for his alloy. By using such a formula the percentage of copper can be greatly reduced simply by the addition of a small percentage of zinc. The four-metal formula eliminates the factor of rapid discoloration of the amalgam, since only a small percentage of copper is required when zinc is employed. So it will be seen that the manufacturer is confined to the use of these four metals for the formulas of his medium-priced alloys, since the extremely high price of gold and platinum metals precludes their use entirely.

These tests prove that the quick-setting formula is the best tooth preserver. You will recognize No. 6 formula to be Dr. Black's, which is used by all makers of quick-setting alloys. Owing to its very quick-setting features this amalgam has never been very popular. In a great many instances have fillings failed that were made from quick-setting alloys. The lack of edge-strength and crumbling nature of these fillings proved conclusively that they had failed due to premature setting or crystallization of the amalgam. Many operators are in the habit of working the soft amalgam in the palm of the hand to prevent it from setting. In many cases they carry this operation too far, and the result is a filling which soon crumbles to pieces. As a matter of precaution, where large fillings are to be inserted it is the best policy to make two mixes when using quick-setting alloys.

All medium and slow-setting alloys produce slightly shrinking amalgams. The very best medium-setting alloys average from 8 to 16 points shrinkage. My experiments have aided me in producing a medium setting, 60 per cent silver alloy, having from 2 to 3 points of shrinkage.

By carefully annealing my 68 per cent silver formula I have produced a medium-setting alloy that will show neutral results on the micrometer. I have yet to find other medium-setting alloys that will show such efficient results.

Again referring to my tests, you will note that for each increase in the thickness of shaving there is a corresponding decrease in the shrinkage factor of the amalgam. You

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must bear in mind that there is a limit to the cutting process and that No. 4 cut is entirely too coarse for quick-setting alloys. Less mercury is required to make a perfect mix of the No. 4 cut than for the No. 1. When wafering the amalgam, more mercury can be expressed from cut No. 4 than from cut No. 1. These facts account for the greater amount of shrinkage in the thinner shaved alloys. It all depends upon the nature of the formulas as to how thick the shavings should be cut.

In conclusion, I will state that it is impossible for any manufacturer to better his product without the use of the micrometer. This delicate instrument is just as necessary to the alloy maker as the analytical balance is to the chemist. Every batch of alloy should be standardized, and the micrometer is the only practical instrument for this purpose. They are regarded as an expensive luxury by most manufacturers, therefore they have not come into general use.

COMPENSATION AMALGAM ALLOY.

Fenchel.

1.

Silver	55 parts
Tin	45 "
Copper	3 "

Cut into fine filings.

2.

Silver	40 parts
Tin	55 "
Copper	3 "

Cut into fine filings.

3.

Silver	50 parts
Tin	45 "
Platinum	2 "
Gold	3 "
Zinc	3 "
Copper	3 "

Cut into coarse filings.

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Mix the above cut alloys without further melting according to the following formula:

No. 1.	3 parts
No. 2.	3 "
No. 3	1 part

REFINING OF MERCURY.

1.

Two pounds of mercury are placed in a strong bottle with 4 ounces of water and 1 ounce of ferric chloride solution and mixed by agitation until the mixture becomes a grayish magma. Let stand in a cool place for two to three days, remove the watery portion, wash the mercury with diluted hydrochloric acid and hot water until it assumes a bright color. Dry the mercury by placing a few thicknesses of filter paper in a large porcelain dish, pouring the mercury over it and repeating the operation two or three times. Finally run the mercury through a cone of filter paper with a pinhole at its apex.

2.

Place the mercury with finely powdered loaf sugar and water in a strong bottle, cork, and shake vigorously. Then by means of a bellows blow air into the bottle, again corking and shaking the bottle, repeating this process several times. Finally run the mercury into a cone of stiff paper with a pinhole at the apex. The mercury filters clear from the metallic oxides produced by the action of air and sugar upon the debasing metals in the impure mercury.

3.

The distillation of commercial mercury from an ordinary glass retort provided with a Liebig condenser produces chemically pure mercury.

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TO IMPROVE THE AMALGAMATION OF DENTAL ALLOY.

Mix the alloy and mercury by shaking in a thick-walled test-tube and pass once or twice through the flame before kneading in the mortar.

MODERN AMALGAM ALLOYS.

	Silver, per cent.	Tin, per cent.	Copper, per cent.	Zinc, per cent.	Gold, per cent.	Platinum, per cent.
Acme	65.00	29.00.	5.00	1.00		
Ash & Son's . .	66.54	27.16	5.02	0.90		
Black's . . .	68.50	25.50	....	1.00	5.00	
Davis' . . .	42.41	51.42	3.21	....	3.20	
Eureka . . .	55.00	40.00	3.00	2.00		
Fellowship . .	67.45	26.80	5.73	0.55		
Fidelity . . .	67.76	26.30	4.71	1.23		
Flagg's contour .	64.00	32.00	....	....	4.00	
Flagg's submarine	60.00	35.00	5.00			
Fletcher's . .	40.00	56.00	....	....	4.00	
Gibraltar . . .	68.50	25.50	5.00	1.00		
Globe	44.89	51.90	....	0.50	2.71	
Hedstrom's . .	66.00	27.00	5.00	2.00		
Herbst's . . .	53.85	38.46	....	....	7.69	
Hodgen's . . .	53.00	42.30	4.70			
Justi's Superior .	35.20	69.10	3.50	1.80	0.32	0.8
Lawrence's . .	44.06	50.43	5.51			
Lorenz's . . .	49.79	48.87	0.70	....	0.37	
Micrometric . .	67.14	26.64	4.31	1.91		
Odontographic .	66.87	26.48	6.21	trace	0.28	
Rego	66.54	28.14	4.21	1.06		
Sauer's . . .	41.67	50.00	....	....	8.33	
Skogsborg's . .	56.00	40.00	....	....	4.00	
Standard . . .	53.55	35.03	2.76	....	8.82	
Sterion . . .	61.89	31.85	4.16	2.10		
True Dentalloy .	65.91	27.13	5.21	1.52		
Twentieth century	67.03	27.13	4.87	1.10		
Welch's . . .	46.00	51.90	....	....	1.70	0.40
Witzel's . . .	53.00	40.00	5.00	....	2.00	
Zsigmondy's . .	50.00	33.33	....	....	16.67	

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TO PREVENT AMALGAMATION OF GOLD IN THE MOUTH.

Coat the gold with a quick-drying mastic—or sandarac varnish prior to placing the amalgam filling.

REFINING OF PRECIOUS METALS.

The refining of precious metals requires an intimate chemical knowledge and an extended experience with the various methods involved. To refine small quantities of gold, silver or platinum is not a profitable process for the busy dentist. It is far more economical to collect the precious metal scraps, filings, etc., until $100 worth are accumulated. They may then be melted and sent to a United States sub-treasury, which in due time will remit a check representing the actual value of the material, or the gold may be sold to a reliable refiner.

The refining of gold in the dental laboratory may be successfully carried out by a number of methods, of which the following are especially adapted to the needs of the practitioner. The dry method, the quartation method, and the wet method are available for this purpose.

The Dry Method.

1. Remove particles of plaster, wood, base metals, platinum pins, etc., from the scraps.
2. Pass a magnet through the scraps to remove iron particles.
3. Wash the gold scraps in boiling water and dry them upon filter paper.
4. Place the scraps in a crucible lined with borax, and cover with a mixture of 3 parts of borax and 1 part of saltpeter. Heat and keep in a molten state for half an hour, adding small amounts of sal ammoniac from time to time. Stir thoroughly with a compressed carbon rod (electric light carbon) and pour into a suitable ingot mould. If the gold is still too brittle when passed through the rolling mill, certain base metals have not been fully removed. The gold is again

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melted and small quantities of mercuric chloride (corrosive sublimate) are added. Extreme care should be exercised not to inhale the very poisonous fumes of the sublimate. The dry method of refining gold produces good results if the gold scraps are fairly uniform in character; platinum and iridium remain unchanged in the gold, while all the base metals are removed as oxides or chlorides. A few Dixon black lead crucibles, a small Fletcher injector furnace, and a hood to carry off the fumes, constitutes the simple outfit. Very small quantities of gold scraps may be fairly well refined by employing the above process upon a piece of charcoal, using a good compound blow-pipe for melting the gold.

The Quartation Method.

It consists in melting the gold scraps with about three times their weight of pure silver; the alloy is poured into a bar ingot mould and the cast ingot is rolled out into thin ribbons. These ribbons are then coiled in a spiral and placed into hot commercial sulphuric acid. The silver and base metals are dissolved and the gold remains in a porous mass which, after washing in water, may be melted and poured into moulds. Platinum and iridium are not removed by the quartation method. The gold produced in this way is about 995 per cent pure.

The Wet Method.

Not less than 1 ounce of gold scraps or precipitated waste gold should be used in refining by the wet method. To prepare waste gold for refining, precipitate the waste gold solution with iron sulphate, dissolved in water. Eight parts of the washed and dried sediments are mixed with

Potassium carbonate	4 parts
Sodium chlorate	2 "
Powdered common bottle glass . . .	2 "

Place in a crucible and melt. Stir with a compressed carbon rod and pour into a mould.

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Gold scraps for refining by this method are prepared as outlined under: The dry method.

Place an ounce of prepared gold in a porcelain dish and cover it with aqua regia; 4 ounces of the acid are required for each ounce of gold. Aqua regia for such purposes should be freshly prepared by mixing 1 ounce of nitric acid with 3 ounces of hydrochloric acid; only C. P. acids are to be used. Place the dish in a sand-bath and apply heat until the gold is dissolved. Care should be taken to allow the poisonous fumes to be carried off, as they are dangerous to the health of the operator and especially destructive to metal instruments, etc. Decant the clear solution from the sediment, evaporate it to a syrupy consistency, and carefully add, with constant stirring, about ½ ounce of hydrochloric acid. Again heat until the acid is removed. Dilute the solution with ½ gallon of distilled water, heat for an hour, and set aside for twenty-four hours to allow the freshly formed silver chloride to settle. Filter through paper into a large glass bottle and wash the remaining silver chloride three or four times with hot distilled water, running the washings into the original filtrate. Add to the contents of the bottle 1½ ounces of ammonium chloride, shake well until dissolved, and set aside for twenty-four hours. Any platinum present is precipitated as platinic sal ammoniac.

The liquid is now filtered through a wet paper filter and the remaining platinic sal ammoniac is washed with a pint of boiling distilled water to which 2 drachms of sal ammoniac have been added. The whole precipitate is now poured into the filter and the liquid is drained off.

To precipitate the gold from the solution, oxalic acid, sulphurous acid, ferrous sulphate, and other chemicals are used. Iron sulphate is well suited for working with small quantities. For every ounce of the original gold, 4 ounces of ferrous sulphate are required. The iron sulphate is dissolved in 1 pint of distilled water and filtered into the gold solution; the gold will be precipitated in the form of a brown powder. About 20 drops of hydrochloric acid are added,

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the bottle is vigorously agitated and set aside for twenty-four hours to allow complete precipitation. The gold magma is now filtered through paper and repeatedly washed with hot distilled water. After the filter containing the gold has become perfectly dry, it is placed in a crucible, covered with a mixture of 2 parts of borax and 1 part of saltpeter, and heated until the gold becomes fluid, and it is then poured into a suitable ingot mould which has been previously slightly oiled and heated.

To recover the silver, place the dry filter containing the silver chloride in a crucible and cover with a mixture of 6 parts sodium carbonate and 1 part powdered charcoal; heat until the silver becomes fluid, and then pour into a suitable ingot mould which has been previously slightly oiled and heated. After melting, the silver will be found in the bottom of the crucible.

Platinum is recovered from the platinic sal ammoniac by burning the dried filter in a porcelain capsule. The capsule is subjected to a slow continuous red heat until all ammonium chloride is driven off. The platinum will remain in the form of a grayish-black mass, known as platinum sponge. The platinum sponge is now melted on a piece of soft charcoal with the oxy-hydrogen blow-pipe into a button of pure platinum.

THE WORKING OF STEEL.

Dr. C. C. Allen.

The giving of a certain desired degree of hardness to a piece of steel has come generally to be called tempering, but, scientifically speaking, the tempering of a piece of steel does not refer to any particular degree of hardness it may have at any particular time, but refers to the percentage of carbon contained therein. Thus two specimens of steel, each containing a different percentage of carbon, might both be brought by proper manipulation to an equal hardness; but the term "temper" is so universally used in referring to the process of obtaining some desired degree of hardness

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that it has come to be correct. The ordinary method of tempering steel is to heat the articles to be tempered to a bright red heat, but not above the point of recoalescence, and plunge into water, oil, mercury, or some tempering solution, thereby depriving the heated metal of its heat more or less suddenly; and the quicker the heat is extracted from the metal, the harder it will be. After this is done, most articles are found to be harder than is desired and too brittle to be useful, but a part of the hardness is removed from the steel by resorting to the process known as drawing the temper. This is accomplished by reheating to a less degree and quenching when the color of the piece indicates to the experienced eye that the desired degree of hardness has been reached. These colors run from almost a dead white to what is generally known as a steel blue—thus a range of degrees of hardness from the natural annealed condition of the metal to the utmost hardness which it is capable of receiving. A list of the colors as generally given is as follows: Pale yellow, straw-yellow, brownish-yellow, purplish-brown, purple, light blue, dark blue, blackish-blue. Temperatures range from 430° to 600° Fahrenheit.

Where great accuracy in temper is desired for a number of articles, such as burs, excavators, etc., they are heated in large quantities, and great precaution is taken to heat only to such a degree as will give the best temper for the purpose.

No two lots of steel are exactly alike in the percentage of carbon contained, and therefore it may be determined beforehand what particular degree of heat is best suited to the material to be worked. The hardening of steel articles is always accompanied by a certain amount of change of form, and this change of form, while slight and of no moment in such cases as burs and excavators, is very serious in many other articles. Various schemes are employed to obviate this working in delicate pieces of work. Thus sheets of metal are liable to curl up to such a degree as to be useless, and are sometimes hardened between plates of

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cold steel, which keeps them straight. Many articles are straightened with wooden mallets after having been hardened—this is the case with such things as small files, ribbon saws, etc.; but an article once tempered does not admit of much further manipulation.

Again, many articles are ground into shape after having been hardened. This is always the case when hard steel bearings are made for fine machinery.

The art of tempering is one which requires much experience in order to obtain the best results, but it is an interesting thing and everyone should know something about it. In addition to tempering tool steel or steels which contain a sufficient amount of carbon to make it practicable to harden them in the usual way, we have a method known as case-hardening. Case-hardening may be employed in low-grade steels or in wrought iron or cast iron, and frequently is so treated where it is practicable to have the surface only of an article hardened. The process consists in converting the surface of the metal into steel, which surface is, of course, hardened as other steel is. The layer of steel thus produced is usually very thin. This may be accomplished in a number of ways. One way which is used a great deal is the heating together of yellow prussiate of potash and some substance which contains a great deal of carbon, such as leather shavings. This combined with the articles to be hardened, is heated in a closed vessel to a red heat and held at this heat for some length of time, when the articles are taken out and plunged into cold water. If this process is properly carried out the metal will be found to have a surface too hard to be filed. Another and a cleaner way, and one better adapted to our wants, is to heat the article or articles to be case-hardened with cyanide of potassium in an iron vessel to a good bright red, then remove the articles with pliers and, while still red hot, plunge them into water. The result noted before will be obtained. In each case a part of the carbon of the mixture combines with the iron to make steel. Potassium cyanide melts and will bear a red heat without

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change; but it should always be borne in mind that this is a very dangerous poison.

In working steel and fashioning it into its desired form it is nearly always desirable that it shall be soft, and many times it is also desirable that the finished article should be soft. The process of softening steel or any other metal is called annealing. To anneal steel it is necessary to bring it to a red heat and then cool it very slowly—the opposite, in fact, to the process of hardening. Large articles of steel may be fairly well softened by heating as mentioned and allowing to cool in the atmosphere; they should, however, be buried in some material which retards the radiation of heat. One of the best ways is to pack in sawdust; lime is sometimes used, also powdered charcoal. Small articles, such as broaches, needles, etc., to be annealed, must be protected from the atmosphere after heating, or they will be found to be brittle. This is because the atmosphere itself robs them of their heat so quickly that they are hardened. The slow cooling of articles to be annealed is supposed to be necessary to give the molecules time for rearrangement. But, unfortunately for this theory, there are metals which are best annealed by sudden cooling.

Steel, besides being rendered softer by annealing, is made more malleable and ductile. One great change in it is its loss of tensile strength. A piece of steel which is properly tempered and will bear a strain of 225,000 pounds per square inch is not safe under a greater strain than 85,000 pounds if it is well annealed. A familiarity with steel and iron is well worth the while of any dentist.

TEMPERING STEEL.

Steel of a grade suitable for tools, hardened by heating to a hardening heat and cooled in cold water, and then reheated to about 425° F., is of just about the right hardness for engraving tools, small lathe tools, etc. Reheated to 500° F., it is suitable for taps, dies, drills, etc.; 550° F. makes it just about right for cold-chisels, saws, etc.; 575° F. leaves but

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little hardness in the steel, but enough to make it suitable for springs. At about 650° F. the effect of hardening is all gone and the steel has become soft again. In practice the temperature is determined by the change in color of a polished surface of the steel; at 425° F. it is a very pale yellow, and as the temperature is increased it becomes straw color, chocolate, tinged with crimson, light purple, dark purple, and finally blue. Dental cavity-forming tools should be quite hard at the cutting surfaces and approaching a spring temper just beyond. All tools used in the root canals should be very little harder than a spring temper—just sufficiently hard to cut soft bone, yet not at all brittle.

Color Scale of Temperature in Tempering of Steel.

430°—450° F. pale straw = enamel chisels.
470° F. full yellow = excavators.
490° F. brown = pluggers; scissors.
510° F. brown with purple = saws; axes.
530° F. purple = knives.
550° F. light blue = watch springs.
560° F. full blue = augers.
600° F. dark blue = hand saws.

Color Scale of Temperature.

This table is the result of an effort to interpret in terms of thermometer readings, the common expressions used in describing temperatures. It is obvious that the values are only approximations.

Color.	Temperature deg. F.
Incipient red heat	900–1000
Dark red heat	1200–1400
Bright red heat	1500–1700
Yellowish red heat	1900–2100
Incipient white heat	2300–2500
White heat	2600–2800

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ROUGH METHOD OF ESTIMATING HIGH TEMPERATURES.

	Temperature deg. F.
Zinc melts at	800
Slight glow in dark at	975
Dark red heat at	1280
Cherry-red heat at	1650
Bright cherry-red heat at	1800
Silver melts at	1900
Gold melts at	2012
Orange heat at	2100
Copper melts at	2190
White heat at	2350
Steel melts at	2465
Dazzling white heat at	2750
Wrought iron melts at	2900
Platinum melts at	3240

TEMPERATURE PRODUCED BY VARIOUS FLAMES.

The highest temperatures afforded by flames are, according to Fery, as follows:

	Temperature deg. F.
Bunsen burner, with sufficient access of air	3400
Bunsen burner, with insufficient access of air	3105
Acetylene flame	4645
Denayrouz's burner (alcohol and air)	3383
Denayrouz's burner (alcohol and petroleum ether, equal parts)	3700
Alcohol flame	3100
Hydrogen flame in open air	3450
Oxyhydrogen mixture	4390
Oxygen and illuminating gas-blast flame	4000
Electric arc (estimated)	6800
Temperature of the sun (estimated)	14,075

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HEAT CONDUCTING POWER OF METALS.

Silver	100	Tin	14
Copper	74	Bismuth	12
Gold	53	Iron	12
Zinc	36	Lead	9
Brass	24	Platinum	8

CONTRACTION OF CASTINGS IN COOLING.

Cast iron	0.125 per cent
Copper	0.193 "
Brass	0.210 "
Lead	0.319 "
Tin.	0.278 "

TO TEST NEW CRUCIBLES.

Heat to redness and put a cold iron rod into crucibles, touching the bottom. Cracks will expand and may easily be seen.

TO TEMPER BROACHES, BURS, ETC.

Cover the bottom of a box, made of sheet iron, with powdered animal charcoal to the thickness of about one-sixteenth of an inch. Animal charcoal is readily prepared by burning pieces of leather in a covered iron box. Place on the charcoal a layer of instruments, cover with charcoal, and repeat this process until the box is filled. Heat the box to a dark cherry-red and keep at this temperature for an hour; remove from the fire and at once drop the contents of the box into cold water. Dry the instruments, immerse in coal oil, and place on an iron plate. Heat the plate until the oil starts to burn, remove from the flame, and allow to cool. The instruments will be found to be of a perfectly even temper.

TEMPERING FLUIDS FOR STEEL.

1.

Tartaric acid	1 part
Cod-liver oil	5 parts

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2.

Tartaric acid	47 parts
Rosin	41 "
Mutton tallow	78 "
Charcoal	63 "
Potassium ferrocyanide	39 "
Ammonium carbonate	31 "
Cod-liver oil	234 "

3.

Potassium ferrocyanide	150 parts
Burgundy pitch	250 "
Beeswax	250 "
Mutton tallow	1000 "

4.

Sodium chloride	25 parts
Zinc sulphate	1 part
Ammonium chloride	½ "
Borax	½ "
Potassium nitrate	½ "
Water	250 parts

TEMPERING OF COPPER

1.

Hydrochloric acid, concentrated	5 parts
Ammonium chloride	10 "
Sodium chloride	50 "
Glycerin	800 "
Water	1000 "

2.

Copper may be rendered hard enough for a cutting edge by treatment with potassium ferrocyanide. The copper is melted in a graphite crucible and about 2 per cent of the potassium salt is then added. After standing until the moisture has been driven off, the powder is stirred into the

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melt, which is allowed to stand a few minutes and again stirred. In five or ten minutes it is ready for pouring. The color of the copper is not affected by the flux. The reason for the change is supposed to be the introduction of iron and possible carbon.

TO APPROXIMATELY DETERMINE THE CHARACTER OF A METAL PLATE.

If a drop of concentrated nitric acid is placed upon a metal surface which has been freshly scratched, the resulting color helps to approximately guess the nature of the metal. Pure silver turns gray; brass, light olive-green; German silver, grayish-green; nickel, black. Gold above 18-carat will not show any discoloration; 16-carat gold shows a brownish hue, which deepens with the reduction of the carat.

UNITED STATES MINT TESTS FOR GOLD AND SILVER.

The following is a test for determining whether a coin is good or bad. Use the liquids as near to the edge of the suspected coin as possible, as that is the part worn. A drop of the respective liquid will have no effect on a genuine coin, while it can be plainly seen on the counterfeit. Coins should be scraped slightly before using.

Test for Gold.

Strong nitric acid	39 parts
Hydrochloric acid	1 part
Water	20 parts

Test for Silver.

Nitrate of silver	24 parts
Nitric acid	30 "
Water	580 "

The above tests should be taken in conjunction with diameter, thickness and weight.

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THE TOUCHSTONE AND ITS USE.

Dr. Henry H. Boom.

A method for quickly ascertaining the degree of purity of both silver and gold was so necessary to artificers that at as early a date as 450 B.C. we find the people of Lydia, in Asia Minor, employing the Lydian stone, or touchstone, for this purpose.

THE STONE.

The stone used by the Lydian goldsmiths was, probably, a hard bituminous quartz, although in more recent times black basalt, jasper, slate, and even black marble have been used.

At the present time, jewelers and metal workers use a stone of black basalt, similar in composition to the basaltic columns forming the celebrated Giant's Causeway, in County Antrim, Ireland. The modern touchstone must be densely black in color and of a quadrangular prismatic shape, measuring 1 inch in thickness and from 2 to 3 inches in length.

It should show an entire absence of color, for any lightening of its dense black surface would interfere with a correct appreciation of the color left by metal that has been rubbed upon it. It must not be too hard, or in its use it will acquire too high a luster. It must not be so soft as to be grooved or furrowed by use; nor should it be of such composition as to be affected by the nitric acid with which the streak of metal left upon its surface is to be treated.

THE TOUCH NEEDLES.

These are needles like masses of pure and of alloyed silver or gold, the exact composition of which is known.

The silver needles are prepared from pure silver, alloyed with pure copper in varying proportions. The first mass of silver selected is that which we would now call chemically pure. Of such metal the manufacturer weighs out 1 mark,

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or 8 ounces, and, fusing the mass under borax, flows the metal into moulds that give to the finished needle a size of $\frac{1}{12}$ inch in breadth, $\frac{1}{48}$ inch in thickness, and $1\frac{1}{2}$ inches in length. This needle is stamped I to indicate its degree of absolute purity.

The second needle of the series is then made by weighing exactly 15 half ounces of pure silver and $\frac{1}{2}$ ounce of pure copper, and this mixture, wrapped in paper, is introduced into a clean new crucible already heated and containing melted borax. The contents of this crucible, maintained at a temperature sufficiently high to melt the metal, are stirred vigorously with a wooden stick that has been charred at the end; the metal alloy is then poured into a mould, and, when cold, is weighed with care; when, should it be found to be less in weight than a mark, or 16 half ounces, it will have lost, through vaporization, so much of its silver as to unfit it for use in making the touch needles.

When a perfect alloy is obtained it is remelted under borax, at a much lower temperature than was required in its making, and is moulded in the appropriate needle shapes. These finished needles are stamped 2. The remaining six needles—in increasing proportions of copper—are made in this same careful manner.

GOLD-TOUCH NEEDLES.

The needles are made of the same breadth and thickness as the silver needles, but, to lessen the expense, they generally are made but $\frac{1}{4}$ or $\frac{1}{2}$ inch in length, and these, called points, are soldered to copper bars of corresponding sectional area.

A number of series of gold-touch needles, or points, are used; thus, gold alloyed solely with silver forms a series known as the "white alloy" series; another series of gold points, called "red gold" points, are composed solely of gold and copper. The most careful gold-touch needles for the dentist's employment are alloys of gold, silver and

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copper, called the "mixed alloy." The touch needles of mixed alloy are made from gold debased with varying proportions of silver and half as much copper.

In making the alloys for the needles the manufacturers must employ the greatest care, that there may be no loss of metal (gold and silver) through volatilization or oxidation (copper). When the alloy is obtained it must not vary in weight from the sum of the weights of its constituent metals. For convenience in their use the touch needles are usually strung upon rings.

THE USE OF THE TOUCHSTONE.

Each metal, when pure, has a specific color. Alloying a metal changes its color. Metals are so opaque that their colors are only determined with accuracy when a thin film of the metal is spread upon a densely black surface. In using the touchstone the operator first cleans a portion of its surface, using for this purpose fine coal dust, tripoli or putty powder.

He then rubs the gold (of unknown fineness) upon the stone, stroking the stone several times with the gold. The metal streak of gold left upon the stone should be $\frac{1}{10}$ inch in width and at least $\frac{1}{4}$ inch in length. Then, selecting a touch needle that appears to be of about the same fineness (color) as the specimen he is testing, he makes a metal streak with the touch needle upon the stone, close to the first streak, and then wets each streak with water and compares their colors when moistened. Should the colors of the two metal streaks fail to correspond, he tries with another touch needle, of lower or greater fineness, to match the color given to the surface of the stone by the metal of unknown composition.

In all this examining of color he must not forget to moisten the metal streaks. When the operator, employing a needle, secures a metal streak on the stone that corresponds to the streak given by the metal tested, he then wets each streak

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with nitric acid, and the acid, dissolving from the streaks the silver and copper used to debase the gold, causes the latter to present in the streak a broken or interrupted line, indicating by the loss of continuity the relative amount of debasing metal alloying the specimen of gold. By this method of testing it is possible for the dentist to ascertain, like the jeweler, the carat or fineness of gold, in a very few minutes, and so be able to select the solder or plate best suited for each piece of repair work he may undertake.

TO RESTORE TARNISHED GOLD PLATES TO THEIR ORIGINAL COLOR.

Iron oxide, red (Crocus martis) . . .	3 parts
Calcined borax	2 “
Ammonium chloride	1 “

Powder and mix slowly with water to form a paste.

Paint over the plate, heat on a copper pan until no hissing sound is heard, place aside to cool, and boil in diluted hydrochloric acid and dry in sawdust.

POLISHING POWDERS.

For Brass.

Chalk	10 parts
White bole	4 “
Magnesium carbonate	1 part
Iron oxide	1 “

For Gold or Silver.

Chalk	54 parts
Magnesium carbonate	5 “
Alumina	14 “
Silica	8 “
Iron oxide	5 “

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GOLD POLISHING FLUID.

Chlorinated lime	1 part
Sodium bicarbonate	20 parts
Sodium chloride	1 part
Water, enough to make a paste.	

Apply with a soft brush, and, when dry, polish.

SILVER POLISHING FLUID.

Sodium hyposulphite	16 parts
Ammonium chloride	8 “
Ammonia water	4 “
Potassium cyanide	4 “
Water	120 “

CLEANING OF SILVER BY ELECTROLYSIS.

A few strips of zinc are shaped so as to form a grid. The ribs of the grid are heavily coated with tin and placed on the bottom of a tin pan of convenient size. The pan is filled with 2 quarts of water, in which 1 ounce of sodium chloride and 1 ounce of sodium bicarbonate are dissolved. The tarnished silverware is placed on the grid, and immediately the evolution of hydrogen takes place, which will remove the tarnish in a few minutes. The silverware must be completely covered by the solution. The silver itself will not be affected by this process, only its oxides are removed.

LIQUID METAL POLISHES.

1.

Kieselguhr	56 parts
Kerosene	30 “
Alcohol	15 “
Oil of turpentine	5 “
Ammonia water	5 “

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2.

Tripoli	10 parts
Kieselguhr	10 "
Olein	15 "
Carbon tetrachloride	90 "

3.

Prepared chalk	100 parts
Olein	65 "
Ammonia water	40 "
Alcohol	50 "
Carbon tetrachloride	50 "

4.

Olein	10 parts
Stearic acid	5 "
Infusorial earth	20 "
Oil of turpentine	20 "
Kerosene oil	25 "
Wood alcohol	5 "
Ammonia water	6 "
Water	6 "

5.

Putty powder	6 parts
Kieselguhr	20 "
Bath brick	2 "
Emery	1 part
Rottenstone	1½ parts

Mix well together and gradually add the following:

Wood alcohol	30 parts
Oil of turpentine	15 "
Petrolatum	80 "
Ammonia water	15 "
Oil of citronella	½ part

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Note.—The difficulty experienced with most liquid metal polishes is to keep the polishing ingredients in suspension. If the vehicle is made too heavy, as with a crude ammonium oleate compound, a wide-mouthed bottle is necessary, while the problem with a thinner preparation is to prevent the kieselguhr from caking at the bottom of the bottle. A mixture of ordinary kerosene oil and crude oleic acid makes a good vehicle for liquid metal polish or "Putz". One part of kerosene to 5 parts of crude oleic acid is about the right proportion to use, and to 8 parts of such a mixture there may be added 1 part of kieselguhr and 10 or 12 drops of oil of mirbane.

METAL POLISH IN POWDER FORM.

Ferric oxide	2 parts
Sodium hyposulphite	3 "
Pipeclay	10 "
Kieselguhr	28 "

POLISHING PASTES.

1.

Pumice stone (in fine powder)	20 parts
Oleic acid, crude	20 "
Tallow	2 "
Paraffin	4 "

Melt the oleic acid, tallow, and paraffin together and gradually stir in the pumice stone, stirring continuously until cold.

2.

Carnauba wax	100 parts
Oleic acid, crude	550 "
Tripoli	350 "
Oil of mirbane	3 "

TO CLEAN NICKEL INSTRUMENTS.

1.

Place the instruments in a mixture of

Sulphuric acid	1 part
Alcohol	50 parts

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Let remain for ten minutes, remove, wash in hot water, and dry in sawdust.

2.

Prepared chalk	2 parts
Ammonia water	2 "
Alcohol	2 "
Water	4 "

Rub the instruments with a cloth saturated with the mixture, then wipe them with a dry cloth.

3.

Ammonium carbonate	30 parts
Water	120 "

Dissolve and add

Precipitated chalk	480 parts

Spread this paste over the surface of the object to be polished and rub with a soft flannel first, then with a piece of chamois skin. If the metal surface has any pits or fissures, a brush may be employed.

4.

Cover the rust spots with engine oil and in a few days rub and polish with a paste made of chalk and ammonia water. If the spots are very resistant they may be treated with diluted hydrochloric acid, followed immediately by the above paste.

5.

One of the best methods known for keeping bright the nickel work about the office is to wet a rag with a solution of hyposulphite of soda and wipe the article with it, drying with a soft towel and then rubbing it with a piece of chamois.

TO REMOVE RUST FROM POLISHED STEEL.

1.

To remove rust from polished steel, potassium cyanide is excellent. Soak, if possible, the instrument to be cleaned

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in a solution of potassium cyanide in the proportion of 1 part of cyanide to 4 parts of water. Allow this to act until all loose rust is removed, and then polish with cyanide soap. The latter is made of potassium cyanide, precipitated chalk, and white castile soap. Make a saturated solution of the cyanide and add chalk sufficient to make a creamy paste. Add the soap, cut in fine shavings, and thoroughly incorporate in a mortar. When the mixture is stiff, cease to add the soap. It should be remembered that potassium cyanide is a violent poison.

2.

Rusted surgical instruments, etc., are placed over night in a saturated solution of stannous chloride, which causes the spots to disappear by reduction. The articles are then rinsed in water, laid in a hot solution of soda soap, and dried. It is well to rub them with absolute alcohol and prepared chalk. Another convenient method for removing rust is to lay the instruments in kerosene. Paraffin oil is the best preservative against rust, and the most convenient way of applying it without getting an unnecessarily thick coating is as follows: One part of oil is dissolved in 200 parts of benzine, and the objects, after being thoroughly dried and warmed, are plunged into the solution. Instruments with joints, as scissors or needle holders, are washed in the fluid, in order to cause it to penetrate into all crevices, and the benzine is then allowed to evaporate in a dry-room.

TO CLEAN ENGRAVED COPPER.

Wash thoroughly with soap and water, and dry thoroughly. Then rub the surface with a fresh lemon cut in half, rinse with tepid water, dry, and polish with chamois leather. Powders and polishing pastes should never be used on worked copper, for the particles get lodged in the chasings and are very difficult to remove.

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LINING OF RUBBER DENTURES WITH ALUMINUM.

La Salle.

For the solvent use chloroform 1 part, carbon disulphide 1 part, and naphtha 1 part; for powder, the aluminum used by plumbers in bronzing metal work. Pack the case as usual, using the flask press and the wet cloth to test the pack. An excess of rubber is fatal to the best results. The flask should be made to come together under gentle pressure. The palatal surface of the denture should be made of as large pieces as possible. This gives a smooth surface and prevents penetration of the mass by the lining—an event certain to mar the appearance of the palatal surface of the denture. After packing, a swab of cotton wound on a wood toothpick is dipped into the solvent and applied to the palatal surface of the pack, and a small quantity of the powder dusted on to this moistened surface and rubbed in with the swab, again saturated with the solvent. This procedure is continued until the surface refuses to hold more. A new swab is then made and used dry, and with it dry aluminum is applied to the model. The flask is then closed and bolted, and the case vulcanized. With the vulcanization completed, the flask is allowed to become "stone cold" before opening. Without this precaution the lining would adhere in part to the model.

TO MAKE GOLD COHERE UNDER ALL CONDITIONS.

Dodel.

When it is advisable to repair an old gold filling without removing the gold already in position, it may be accomplished by following the directions here outlined:

(1) Apply the rubber dam. (2) Clean the tooth carefully with lukewarm water. (3) Wash it with sulphuric ether, to dissolve any fatty or oily substances. (4) Go over the filling with alcohol. (5) Dry with warm air. (6) Take a gold cylinder and unroll it, until you have but one thickness, or take gold foil No. 4; carefully anneal this, as it readily melts. (7) With a very fine pointed plugger go over the entire surface of the gold put on, first with hand pressure,

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then mallet it well. (8) After that, go over it with a convex plugger. (9) The direction of the force should be at right angles to the surface worked upon. (10) If you have followed these directions in applying two layers, you can go ahead in the usual manner and use either pellets or leaf gold. Having tested it in various positions, I find it entirely satisfactory except where the filling is subject to great stress; when it is ill-advised.

TO IMITATE GOLD FILLING IN PORCELAIN TEETH.

Pure powdered gold	100 parts
Mercury oxide, yellow	150 “
Bismuth trinitrate	$9\frac{1}{2}$ “

Mix with thick oil of turpentine, paint upon tooth, and carefully heat in oven or flame. Polish with burnisher.

TO REPAIR A GOLD PLATE WITHOUT REMOVING THE RUBBER-MOUNTED TEETH.

Attach to the plate the negative wire of the lighting circuit, and to the positive wire a small carbon, cutting in, in series, a bowl of salt water as a rheostat. The hole in the plate is cleansed and prepared in the usual way, then covered with a piece of gold foil and 18-carat solder upon it, with borax as a flux. The carbon point is brought in contact with the solder and then gradually removed, forming the arc, which is held sufficiently long to melt the solder. Immerse the plate immediately in water.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER V.

ELECTRO-PLATING, COLORING, LACQUERING, AND ETCHING OF METALS.

ELECTROPLATING OF METALS.

When an electrified body is discharged through a conductor, an electric current is produced, known as the circuit. The circuit represents the entire path travelled by the current, including both that within the cell and that without. The current passes from the negative pole, *i. e.*, the positive plate of the cell, to the positive pole, *i. e.*, the negative plate of the cell. When the poles of a cell are connected by wire immersed in a salt solution in which a piece of metal of the same nature as the salt present in the solution and a piece of metal of a different character are suspended, the piece of metal attached to the negative pole will be covered with a coat of metal as represented in the solution. The process is referred to as electroplating. The negative pole, carrying the article to be plated, is spoken of as the cathode, and the positive pole, carrying the metal to be plated, is spoken of as the anode.

PRACTICAL HINTS TO BE OBSERVED IN ELECTROPLATING.

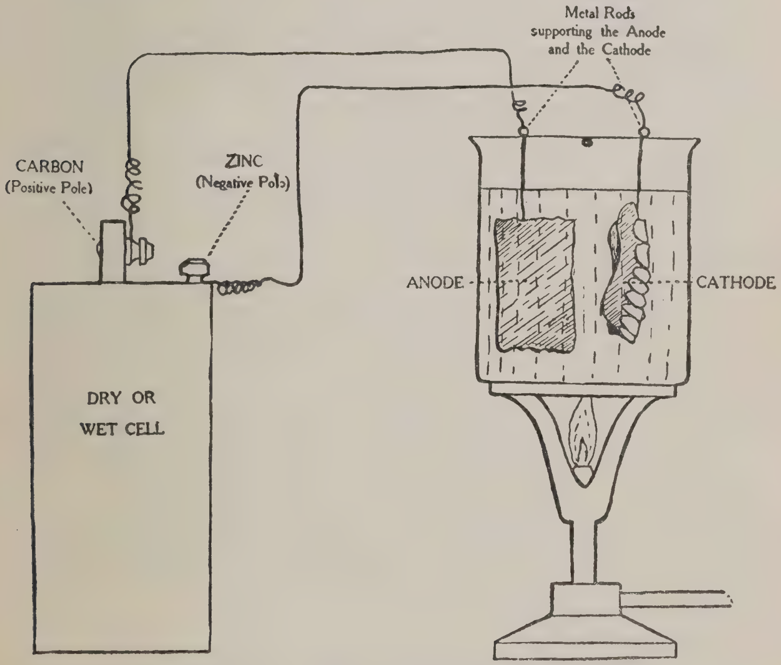
Ordinary dry cells (Columbia type), or wet cells (Leclanché type), furnish the best current for small plating outfits. A Leclanché cell furnishes, in average, $1\frac{1}{2}$ volts; the dry cells, from $1\frac{3}{10}$ to $1\frac{7}{10}$ volts. Ordinarily, two cells are necessary for dental work. The current must never be so strong as to produce small bubbles upon the cathode; too weak a current produces a milk-colored deposit.

Use the purest chemicals obtainable.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Heating the solution to about 100° F. facilitates ready plating.

In making the solution, all the salts, with the exception of the metal salts proper, should be dissolved first, the metal salts are added last.


Metal Rods supporting the Anode and the Cathode
CARBON (Positive Pole)
ZINC (Negative Pole)
ANODE
CATHODE
DRY OR WET CELL

Scheme for arranging a simple electroplating outfit.

Gold or platinum wire soldered to the anode and attached to the article to be plated, the cathode, should be used only. Base metal wire produces poor results.

Between the anode and the cathode, as suspended in the solution, there should be from 1 to 2 inches of space; the articles must never touch each other during the plating

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process. The size of the anode must be equally as large as the cathode.

Articles made of German silver, bronze, or other alloys must be copper-plated before the final gold, silver or nickel plating is made.

The vessels used in plating should be of glass, stoneware or porcelain and must be kept scrupulously clean.

Before immersing the articles in the plating solution it must be boiled in a solution of caustic potash (1 ounce to a pint of water) to remove fat, oil, finger grease, etc. Remove with wire hook and wash in water. Do not again touch with fingers.

If articles are oxidized, they must be boiled for a short time in a weak solution (1 : 10) of sulphuric or hydrochloric acid.

Places which should not be covered by the plating solution must be carefully varnished with asphalt varnish. The varnish must be perfectly dry before the goods are immersed in the plating solution.

The time necessary to accomplish a good plating varies with the size of the article, from one-half to five hours may be required; the color of the plated article is usually the best indicator.

After the plating is accomplished, the article is removed from the solution and boiled in water for a few minutes and the still hot article is thrown in jeweler's sawdust and dried. Polish in the usual manner.

AN INEXPENSIVE GOLD PLATING OUTFIT FOR SMALL WORK.

Dissolve $\frac{1}{4}$ ounce of potassium cyanide in $2\frac{1}{2}$ ounces of pure, warm water. Also 15 grains of gold chloride in $2\frac{1}{2}$ ounces of cold water. Mix the two solutions and pour into a glass or porcelain dish. Procure three pieces of insulated copper wire, each 16 inches in length and about 22 gauge. Remove 2 inches of the insulation on each end of the wires.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Use two of these for connections with a dry cell battery, such as are used for hall bells or alarms.

To the anode attach a piece of pure gold, and to the cathode the appliance to be plated. Immerse in the plating solution after previously cleansing in a heated solution of caustic potash, followed by a wash of clear water. For this cleansing use the third wire and do not handle the appliance with the fingers. Stir the plating solution occasionally. The outfit complete can be procured for about one dollar.

PLATING SOLUTIONS.

Silver Plating Solutions.

1.

Silver cyanide	2 parts
Potassium cyanide	5 “
Distilled water	35 “

Use pure silver plate as the anode.

2.

Silver chloride	3 parts
Sodium phosphate	40 “
Potassium cyanide	25 “
Potassium hydrate	15 “
Distilled water	1000 “

3.

Silver nitrate	68 parts
Distilled water	1000 “

Dissolve, and mix with

Potassium cyanide	104 parts
Distilled water	1000 “

This solution produces a heavy deposit.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Gold Plating Solutions.

1.

Sodium phosphate	25 parts
Sodium sulphate	5 “
Gold chloride	3 “
Potassium cyanide	10 “
Distilled water	560 “

The anode must be attached to a piece of pure gold plate of nearly the same size as the article to be plated.

2.

Gold chloride	10 parts
Potassium cyanide	20 “
Distilled water	1000 “

For Plating Iron and Steel Goods.

3.

Sodium phosphate, crystals	50 parts
Sodium sulphate	12 “
Potassium cyanide	½ part
Gold chloride, crystals	1 “
Distilled water	1000 parts

Copper Plating Solutions.

1.

Copper acetate	20 parts
Sodium carbonate, crystals	17 “
Sodium sulphite, crystals	25 “
Potassium cyanide	20 “
Distilled water	1000 “

Use pure copper plate as the anode.

2.

Copper acetate	20 parts
Sodium carbonate	25 “
Acid sodium phosphate	20 “
Potassium cyanide	23 “
Distilled water	1000 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Nickel Plating Solutions.

1.

Nickel sulphate	10	parts
Sodium citrate	9	“
Distilled water	280	“

2.

Nickel and ammonium sulphate	70	parts
Ammonium sulphate	25	“
Citric acid	25	“
Distilled water	1000	“

Platinum Plating Solution.

Solution 1.

Platinum chloride	4	parts
Ammonium phosphate	20	“
Sodium phosphate	100	“
Distilled water	1000	“

Solution 2.

Platinum chloride	4	parts
Distilled water	1000	“

Both solutions are mixed with constant stirring. A yellow precipitate of platinic ammonium chloride is formed. To dissolve this precipitate add a solution of

Sodium phosphate	100	parts
Distilled water	700	“

and boil the whole mixture until the precipitate is dissolved. After complete solution, the solution is reduced by evaporation to about 1500 parts.

Brass Plating Solution.

Iron, copper or zinc articles may be readily brass plated with the following solution:

Copper sulphate	$1\frac{6}{10}$	parts
Zinc sulphate	10	“
Potassium cyanide	16	“
Distilled water	1000	“

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TO PLATINIZE GOLD.

W. A. Price.

Pour over any form of pure gold fiber, wool, moss, pellets or foil, (a shredded pure gold is preferable), a 10 per cent solution of platinum chloride sufficient to dampen or wet all surfaces and pour or squeeze off the excess. Next pour over it a solution of ammonium chloride and flow it through the mass a time or two to precipitate the platinum chloride as platinum ammonium chloride which forms a yellow precipitate over the surfaces of the gold. Take the water out of the mass by slowly heating or preferably by washing with alcohol. Then heat to a dull red which changes the yellow platinum ammonium chloride on the surfaces of the gold to amorphous spongy pure platinum which combines with the gold when heated to a red heat forming a gold and platinum compound.

The advantages of a shredded gold over a foil or pellets is that the former will not curl and warp away from the margins by the gold flowing on its surfaces which the foil and pellets when used in this way will do. The platinized, shredded gold draws the pure gold into its mass around all sides of each fiber, thus preventing the curling.

GOLD PLATING WITH ALUMINUM CONTACT.

1.

Gold chloride	1½ parts
Potassium cyanide	16 “
Distilled water	1000 “

Dissolve the gold chloride in 500 parts of warm distilled water and the potassium cyanide is 500 parts of warm distilled water. Mix the two solutions. The article to be plated is wound with an aluminum wire and placed in a hot 5 per cent solution of potassium or sodium hydrate; it is now rinsed in water and placed in the heated gold solution. Depending on the size of the article, it may remain in

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the gold-bath from fifteen seconds to two minutes or until a sufficiently heavy deposit is obtained. It is then removed, washed in water and polished in the ordinary way.

2.

Gold chloride (or silver chloride for silver plating)	1 part
Potassium cyanide	25 parts
Sodium phosphate	16 "
Potassium hydrate	10 "
Distilled water	500 "

Boil the solution.

The perfectly clean and highly polished article is held by an aluminum wire and moved about in the boiling liquid for one-half to two minutes; it is then removed, washed in alcohol, and dried in sawdust.

GOLD SOLUTION FOR PLATING WITHOUT A BATTERY.

Sodium pyro-phosphate, crystals	80 parts
Hydrocyanic acid, 12 per cent	8 "
Gold chloride, crystals	2 "

GOLD PLATING OF ALUMINUM BASE PLATES.

After the aluminum base plate is swaged, it is placed in a 10 per cent potassium hydrate solution for a few minutes, removed, washed in water and placed in diluted hydrochloric acid and left there until small gas bubbles are visible upon its surface. It is now immediately transferred to a 25 per cent solution of mercuric chloride, left there a few moments and transferred to the acid bath in which it remains until the gas bubbles again start to form. It is now placed in a 10 per cent gold chloride solution. Immediately it is covered with a tense film of gold, which may be readily polished.

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FIRE GILDING.

Gold-amalgam for fire gilding is prepared by alloying

Pure gold	1 part
Mercury	8 parts

A Dixon black lead or English clay crucible is coated with prepared chalk, the gold is cut into small pieces and heated in the crucible to a dull redness and the mercury added and stirred. Pour in water.

"Quickening" solution is prepared by dissolving (in the open air):

Mercury	10 parts
in	
Nitric acid	11 parts
and adding	
Distilled water	275 parts

Clean the article thoroughly and apply the "quickening" solution; with a copper spatula rub the gold amalgam over the "quickened" surface and remove the surplus of the amalgam with a soft brush. The article is now slightly heated to evaporate the mercury, leaving a pure layer of gold. With prepared chalk and borax solution the article is finally polished.

Caution: Mercury fumes are very poisonous; they must not be inhaled.

SILVER PLATING PASTE.

1.

Silver nitrate	1 part
Sodium chloride	1 "
Potassium cyanide	2 parts
Chalk, a sufficient quantity.	

Dissolve the silver nitrate in 16 parts of water and add the sodium chloride, dissolved in an equal amount of water. Mix thoroughly and collect the precipitate on a piece of

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

damp cotton cloth. Transfer the moist precipitate to a mortar containing the potassium cyanide in powder and dissolve by adding more water if necessary. Now add sufficient chalk to make a spreadable paste.

To resilver the tarnished article spread the paste upon the spot which must be free from grease, dirt, etc., and let remain two hours, then brush off. Repeat if necessary.

2.

Silver nitrate	36 parts
Potassium cyanide	60 "
Precipitated chalk	100 "
Potassium bitartrate	5 "

Water, enough to make a paste.

Dissolve the silver nitrate and potassium cyanide separately in a minimum of water; mix them and add the chalk and potassium bitartrate and sufficient water to make a paste.

SILVERING SOLUTION.

A solution that is considerably used for covering the worn parts of plated goods has the following composition:

Silver nitrate	35 parts
Sodium chloride	60 "
Alum	30 "
Potassium bitartrate	180 "
Water	1000 "

The solution is applied by friction with a sponge or rag to the previously well-cleaned article.

SILVER PLATING OF ORGANIC SUBSTANCES.

Ivory, horns, bone, vulcanized rubber, leather and similar materials may be coated with a layer of silver as follows: The material is heated to about 150° F. and painted over with a hot solution of 2 parts of gallic acid in 100 parts of water. After drying, a 1 per cent solution of silver nitrate

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

in distilled water is painted over the parts and this process is alternately repeated until the desired silver color is obtained.

NICKEL PLATING WITHOUT A BATTERY.

It is not so easy to deposit nickel on the surface of brass as silver, but the following processes represent perhaps, the most practicable methods in use. The first method is known as the Mitressey process, by which any desired thickness of plating may be deposited, yielding a surface which is said to be more solid than electroplated nickel:

1.

First Bath.—Clean the objects and take 5 parts by weight of potassium carbonate for 25 parts by weight of water. If the pieces are quite rusted, take 2 parts by weight of hydrochloric acid for 1 part by weight of water. The bath is employed cold.

Second Bath.—Put 25 parts by weight of copper sulphate in 2500 parts by weight of water. After dissolution add a few drops of sulphuric acid, drop by drop, stirring the liquid with a wooden stick until it becomes as clear as spring water. Take the cleaned pieces and place them in what is called the copper bath, attaching to them leaves of zinc; they will assume a red tint. Then pass them into the nickeling bath, which is composed of:

Platinum bitartrate	20 parts
Ammonium chloride	10 "
Sodium chloride.	5 "
Stannic chloride.	20 "
Nickel sulphate, single	30 "
Nickel sulphate, double	50 "

Remove the pieces from the bath after a few minutes' exposure, and rub with fine sand on a moist rag. Brilliancy will thus be obtained. To improve the appearance apply a brass wire brush.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Prepare a bath of neutral zinc chloride and a neutral solution of a nickel salt. The objects are immersed in the bath with small pieces of zinc and kept boiling for some time. This process has given satisfactory results. It is easy to prepare the zinc chloride by dissolving zinc in hydrochloric acid, as well as a saturated solution of ammoniacal nickel sulphate, in the proportion of 2 parts of the latter to 1 of the zinc chloride. The objects should be boiled for fifteen minutes in the bath. Nickel chloride may also be employed.

PLATINUM PLATING OF DENTAL INSTRUMENTS.

Platinum chloride	1 part
Water	1 "
Hydrochloric acid	3½ parts
Alcohol	20 "
Dissolve and evaporate to	15 "
And add	
Ether	75 parts

With a woollen cloth rub this liquid upon the clean instrument, heat to about 100° F. and polish.

COPPER PLATING ALUMINUM.

Copper sulphate	30 parts
Potassium and sodium tartrate	30 "
Sodium carbonate	25 "
Water	1000 "

The aluminum article is thoroughly cleansed in a weak potassium hydrate solution and placed in the heated bath.

COPPER PLATING WOOD.

First, the wood is rendered impervious by saturating with a wax varnish, which is then coated with a thick linseed-oil varnish. Then a shellac varnish is applied and allowed to

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dry. A thin deposit of silver sulphide is produced by treatment with a silver-nitrate solution made with alcohol and water, the surface being then exposed to sulphuretted-hydrogen gas. Finally, copper is electrolytically deposited on this film.

COLORING OF METALS.

Copper.

Black.—To color copper black immerse the object, previously well cleansed, in the following solution, let remain for from thirty to forty-five minutes, and afterward wash well:

1.

Antimony chloride	15 parts
Alcohol	125 “

Hydrochloric acid, sufficient to dissolve.

The less of the acid that is used, the better the result. This process deposits a coating of antimony.

2.

Plunge the well cleansed object in nitric acid, remove and heat to a dull red. It deposits a coating of copper oxide.

3.

Plunge the copper, previously well cleansed, into the following:

Arsenous acid	2 parts
Hydrochloric acid	4 “
Sulphuric acid	1 part
Water	24 parts

It causes a deposit of arsenic.

Bluish-gray.—Suspend the object in the following solution at an almost boiling heat:

Sodium sulphide	1 part
Antimony sulphide	1 “
Water	12 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Let remain until the desired tint is obtained, wash rapidly with water and dry.

Brown.—Immerse in nitric acid sufficiently long to give a bright surface, rinse in clear water and plunge into a solution of iron chloride.

Olive-green.—Cover with a solution of iron and arsenic in hydrochloric acid. Polish with lead-minimum, warm, and cover with the following varnish:

Gamboge	1 part
Yellow ochre	1 "
Alcoholic varnish	1 "

To make iridescent:

Lead acetate	2 parts
Sodium hypophosphite	6 "
Water	100 "

Mix, and heat to boiling. When in active ebullition, plunge the object in it and keep until the desired tints are obtained. Dry and varnish. The copper takes on, successively, gray, violet, chestnut, red and finally blue.

Bronze.—First tin the copper by boiling in a weak solution of acid potassium tartrate, in which granulated tin has been placed.

Wash, dry, and warm until the desired tint is obtained.

Zinc.

Black.—Clean the zinc by dipping in diluted sulphuric acid, rinse and plunge into the following:

1.

Nickel-ammonium sulphide	4 parts
Sulphuric acid	1 part
Water	40 parts

Wash the article and dry carefully.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Hydrochloric acid	6 parts
Antimony chloride	10 “
Alcohol	100 “

When the desired shade is attained, dry and rub with some good drying oil. Give two or three coats.

Green-platina.—

Sodium hyposulphite	2 parts
Sulphuric acid	1 part
Water	20 parts

Filter off the precipitated sulphur and heat the filtrate. Plunge the object into the hot solution. Watch the coloration as it progresses and when the desired tint is secured, remove, let dry and varnish with copal varnish.

To Bronze.—First cover with copper by galvanism, then wash with the following solution:

Potassium oxalate	8 parts
Ammonium chloride	30 “
Vinegar	1000 “

Rinse and let dry.

Silver.

To Blacken.—Plunge into a solution of an alkaline sulphite (sulphuretted potassa). Remove and rub with a brush dipped in powdered cream of tartar.

Baths for Oxidizing Silver.

The peculiar appearance on the surface of silver articles that has been termed “oxidized silver” can be produced in a variety of ways, the particular tone depending upon the treatment to which the metal is submitted.

A mixture of 6 parts of graphite and 1 part of powdered hematite (or rouge) is prepared, and moistened with oil of

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

turpentine. The surface of the object to be oxidized is covered with this paste, which is allowed to dry, and then dusted off with a soft brush. The object is now immersed in a solution, heated to about 175° F., consisting of 5 parts potassium sulphide, 10 parts ammonium carbonate, and 1000 parts of water. If the following solution be employed a rich brown tone is produced: 20 parts copper sulphate, 10 parts saltpetre, 20 parts ammonium chloride and 1000 parts of water.

Bromide vapor blackens silver and its alloys, and by its use extraordinarily artistic effects can be produced, especially upon engraved surfaces.

The silver objects may also be covered with ammonium sulphide in a porcelain vessel and gradually warmed. As soon as a bluish-black color appears they are taken out of the bath, placed in soap water, and gently rubbed with a soft brush, while immersed.

A bath which produces the same effect as potassium sulphide, can be prepared as follows, and has the advantage of being very cheap: 1000 parts of water are poured over a mixture consisting of 370 parts of quicklime, and 640 parts flowers of sulphur. Considerable heat is evolved, and a pasty mass forms; the latter is diluted with 1000 parts of hot water, and boiled for an hour. The resulting liquid is ready for use, and is best employed after slightly warming. It produces a bluish-gray surface on the silver, while, if 50 parts of gray antimony sulphide or cinnabar be added during the boiling, the color will be a beautiful grayish-brown.

Brownish Color.—To give silver a deep brown, treat it with a solution of ammonium chloride and copper sulphate, equal parts, in vinegar.

To Oxidize Silver.

1.

Light Color.—

Sulphuretted potassa (liver of sulphur) .	5 parts
Ammonia water	10 “
Water	60 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Dark Color.—

Chlorinated lime	10 parts
Sodium chloride	8 “
Sodium carbonate	20 “
Water	30 “

Boil the article in this solution under a good ventilator as intensely ill-smelling gases are produced.

To Oxidize Silver With Platinum.

Platinum chloride	2.3 parts
Water	1000 “
Dissolve and add	
Alcohol	500 “

The silverware, previously cleaned in a caustic soda solution, is immersed in the warmed platinum solution, removed and lightly heated over a Bunsen flame. Care should be taken so as not to burn the alcohol. If the black color is not deep enough, the process is to be repeated.

Rose Color.—Immerse for a few seconds in a concentrated hot solution of copper chloride, rinse, dry and immerse in alcohol. Finally, dry off by holding near the fire.

Iron and Steel.

Bronzing.—Lay the object for a moment in a solution of iron perchloride and copper sulphate with a little added nitric acid. Remove and dry at a temperature of about 85° F. Finally suspend in a closed box containing a vessel of boiling alcohol, and leave for twenty minutes, keeping the alcohol boiling all the time. Scratch off with a scratch brush. Repeat operation several times or until the desired tint is obtained.

Blue-black.—Clean the object thoroughly, removing every trace of grease, then cover with the following:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Copper sulphate	8 parts
Nitric acid	15 “
Alcohol	30 “
Water	125 “

Mix, and dissolve. Let dry on, and when quite dry rub with a woolen cloth.

Brilliant Black.—Boil the following together:

Sulphur	1 part
Oil of turpentine	10 parts

While boiling spread in a very light coating, by means of a brush over the surface and heat in the flame of an alcohol lamp until black.

Brown.—Make the following solution:

Iron sulphate	20 parts
Copper sulphate	2 “
Sweet spirit of nitre	4 “
Water	200 “

Place the iron in the solution, dry and polish with boiled linseed oil.

Bronzing Gun-barrels.—

Solution of ferric chloride	4 parts
Mercuric chloride	3 “
Fuming nitric acid	3 “
Copper sulphate	3 “
Water	80 “

With a brush or pencil go over the barrel with this liquid. Repeat this two or three times. Finally plunge the barrel into a 1 per cent solution of potassium sulphide and let remain for ten days. At the end of the time wash in hot suds, dry off and cover with linseed oil, which let dry on.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Black, Rust-proof Finish for Iron.

A solution is made up of water, 1000 parts, manganese dioxide, 3 parts and phosphoric acid, concentrated, ½ part. This is placed in a suitable receptacle and heated to the boiling point. The iron or steel article, previously cleaned, is immersed in it for from thirty to ninety minutes, when it is removed, wiped and polished with linseed oil.

Brass.

Silver Color.—

Cream of tartar	46 parts
Tartar emetic	4 “
Dissolve in boiling water	1000 “

and add

Hydrochloric acid	50 parts
Tin, granulated	125 “
Antimony	30 “

Bring the solution to a boil, immerse the brass article and dry in sawdust.

Platina.—The green coating—“Platina”—found upon bronze objects, especially such as have laid buried for some time, is not only pleasing to the eye but also serves a practical purpose, in that the metal beneath is protected from further corrosion.

Brass objects can be coated as well as bronzed, by the following solution:

Copper	30 parts
Nitric acid, concentrated	60 “
Acetic acid, 6 per cent	600 “
Ammonium chloride	11 “
Ammonia water	20 “

The copper is dissolved in the nitric acid, and, as soon as solution is effected, the other ingredients are added. The solution must be allowed to stand several days before using.

N. B —Parts as used in this *Dental Formulary* mean quantities by weight.

The objects to be coated are either dipped into the solution for a moment, or the solution is applied to the surface by means of a brush. They are then allowed to dry, and are finally covered with a thin coat of linseed oil.

Steel Blue.—To obtain a beautiful steel blue color, the cleaned brass is dipped in a heated mixture of the following solution:

Solution 1.

Antimony sulphate	12 parts
Sodium carbonate, calcined	120 “
Water	750 “

Dissolve and add

Sulphurated antimony	22 parts

Filter.

Solution 2.

Cream of tartar	22 parts
Sodium hyposulphite	45 “
Water	750 “

Equal parts of solutions 1 and 2 are freshly mixed when needed.

Black.—Mix equal parts of the following solutions when needed.

Solution 1.

Silver nitrate	25 parts
Water	100 “

Solution 2.

Copper nitrate	25 parts
Water	100 “

The cleansed brass is plunged into this freshly mixed solution, removed and heated evenly until the desired degree of dead blackness is obtained.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

BLACKENING OF METALS.

Solution 1.

Silver nitrate	192 parts
Distilled water	480 “

Solution 2.

Copper nitrate	192 parts
Distilled water	480 “

Thoroughly clean the article, especially from grease, and dip into a mixture of equal parts of above solutions. Allow it to remain in this about ten minutes, then remove, and dry naturally. When dry, heat it on a sand-bath until a good deep black color is obtained.

METAL LACQUERS.

For Optical Goods, Microscopes, Etc.

Seed lac	32 parts
Dragon’s blood	½ part
Extra red sanders	½ “
Oriental saffron	½ “
Amber	16 parts
Copal	16 “
Coarsely powdered glass	30 “
Absolute alcohol	320 “

Mix. Keep in a warm place, shake occasionally until dissolved, let settle and pour off the clear liquid.

For Ordinary Brass Goods.

1.

Gum shellac	50 parts
Turpentine varnish	100 “
Turmeric	125 “
Gamboge	16 “
Gum sandarac	25 “
Alcohol, enough to make	1000 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Gum shellac	75 parts
Gum sandarac	75 parts
Venice turpentine	10 “
Alcohol, enough to make	1000 “

3.

Gamboge	1 part
Aloes, Cape	3 parts
Gum shellac, orange	8 “
Alcohol	125 “

4.—Zapon Lacquer.

Celluloid, colorless	2 parts
Acetone	20 “
Amyl acetate	78 “

Lacquer for Silver Articles.

1.

Pyroxylin	25 parts
Gum shellac, orange	3 “
Methyl alcohol	56 “
Amyl alcohol	240 “
Amyl acetate	480 “

2.

Pyroxylin	4 parts
Benzol	50 “
Amyl acetate	70 “

Alcoholic lacquers are best colored with “Aniline dyes for spirit varnishes.” They are obtained from dealers in dye stuffs.

Graphite Lacquer for Iron.

Lead sulphate	20 parts
Tin sulphate	20 “
Ceylon graphite, in fine powder	5 “
Boiled linseed oil	80 “

Mix thoroughly and boil for fifteen minutes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Blue Lacquer for Steel.

White gum shellac	5 parts
Borax	1 part
Alcohol	5 parts
Water	4 “

Methylene blue, enough to give the desired shade.

Dissolve the borax in the water; the shellac in the alcohol. Bring the borax solution nearly to a boil, add the shellac solution under constant stirring and add the methylene blue.

Metal goods to be lacquered must be perfectly clean, especially free from grease; they must be warmed and handled with a cloth to avoid finger touches. Apply the lacquer with a soft camel's hair brush, using the tip only. Apply two to three coats, letting each coat dry perfectly. Warm the articles between the varnishing.

Gold Lacquer for Tin.

Gum lac	16 parts
Dragon's blood	4 “
Turmeric	1 part
Alcohol, wood, 95 per cent	300 parts

Mix and heat moderately on the water-bath to a solution.

Metal Lacquer; to Be Used Without Heat.

Gum shellac	5 parts
Gamboge	5 “
Acetone	30 “
Alcohol	50 “

The lacquering must be done in a warm room, free from moisture. Two or more days should be allowed for perfect drying.

ETCHING.

1.

Ammonium chloride	1 part
Copper sulphate	2 parts
Acetic acid, dilute	4 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Steel.—

Copper sulphate	24 parts
Alum	12 "
Sodium chloride	3 "
Acetic acid	12 "
Nitric acid	1 part
Water, enough to make	120 parts

Mix the acids and the water, and dissolve the solid ingredients in the mixture. Dip the article in boiling water, wipe dry, and either dip into melted beeswax or rub wax on the article, while it is still hot enough to melt it. The design is produced by scratching with a fine pointed instrument through this film of wax. Apply the mixture with a piece of wood, wash off in a few minutes and repeat the process until the etching is of sufficient depth.

The same procedure holds good for the etching of the other substitutes given below:

Brass and Copper.—Mix equal parts of the following solutions when needed:

Solution 1.

Nitric acid	16 parts
Water	100 "

Solution 2.

Potassium chlorate	6 parts
Water	100 "

Zinc.—Mix equal parts of the following solutions when needed:

Solution 1.

Gallic acid	5 parts
Gum arabic	40 "
Water	500 "

Warm the mixture until solution takes place.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Solution 2.

Nitric acid	½ part
Copper sulphate	2 parts
Water	500 "

Glass.—Hydrofluoric acid, a sufficient quantity.

Apply with a glass rod.

Hydrofluoric acid is intensely caustic and requires great care in handling.

Wood.—First cover the surface to be etched with good varnish, and let dry. With a needle point or any similar sharp instrument, draw the lines to be etched, through the layer of varnish, and apply to the design the following fluid:

Potassium bichromate	1 part
Distilled water	6 parts
Sulphuric acid	1 part

Dissolve the bichromate in the water, and add the acid. Let remain in contact until the etching is deep enough to suit, then wash off. The varnish can be removed with any suitable solvent—benzol, alcohol, etc.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER VI.

PREPARATIONS FOR THE MOUTH AND TEETH.

Oral Hygiene.—The science of oral health treats of the preservation of the normal equilibrium of the oral cavity and its contents. The remedies intended for the maintenance of the health of the soft structures of the mouth and the teeth may be conveniently divided into those prescribed for specific diseased conditions and those employed as hygienic measures for daily use. Only those employed for hygienic purposes are claiming our interest at present.

The mechanical cleansing of the mouth and teeth by means of the brush, powder, paste, toothpick, floss silk, etc., constitutes the absolute fundamental principle of artificial oral hygiene. Food remnants and slimy adhesions between and upon the teeth, together with a large number of the adherent bacteria, are principally removed by mechanical cleansing. The mechanical cleansing of the oral cavity by these enumerated means may, however, be materially assisted by the judicious use of suitable mild astringent and indifferent antiseptic solutions. Powders, pastes, and washes containing soluble drugs or drugs in solution are employed for the avowed purposes of assisting Nature in accomplishing the desired means to an end, *i. e.*, they must favor the recovery of an inflamed mucous membrane and they must mechanically remove accumulated food débris.

A good oral preparation should possess the following properties:

1. It must be absolutely indifferent in regard to:
    - (*a*) The mucous membrane—*non-caustic.*
    - (*b*) The teeth—*non-decalcifying* (mechanical or chemical).
    - (*c*) The organism as a whole—*non-poisonous.*

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2. It must not interfere with the normal physiological cleansing of the oral cavity, *i. e.:*
    (*a*) It must not inhibit the secretion of saliva.
    (*b*) It must not perceptibly alter the reaction of saliva.
    (*c*) It must not destroy the ferments of saliva.
3. It must possess sufficient cleansing action, combined with:
4. Good taste and odor.

These various enumerated properties are naturally rarely found in combination in a single oral preparation and yet each one is of the utmost importance.

Hygienic measures as applied to the oral cavity are practised in proportion to the pleasant sensation which they call forth, hence, a mouth preparation which has a disgusting taste is ineffective because it will not be employed for any length of time by the laity. The great mass of the public will never be induced to practice oral hygiene that involves ill-tasting preparations. As stated above, mouth preparations must be absolutely free from danger as far as the mucous membrane, the teeth, and the organism as a whole is concerned. Hence Roese's dictum should be indelibly fixed in the mind of every dental and medical practitioner: The importance of oral antisepsis is not so great that we are justified in assuming the slightest risk. This statement cannot be emphasized too strongly in view of the fact that numberless mouth washes and tooth preparations of questionable character are continuously forced on the market. Unless the correct composition of a ready-made mouth or tooth preparation is known, it should not be recommended.

Preparations which are intended to exercise definite functions on the teeth and gums, the oral mucous membrane, the tongue, the salivary glands, and the tonsils, and to some extent on the breath, are known as *oralia*. This term has, however, never been universally recognized; the physical nature of the preparation has created specific names for definite classes—solid or semi-solid tooth preparations are known as *dentifrices*, liquid tooth preparations are spoken

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

of as *collutoria,* while liquids intended for the pharyngeal regions are referred to as *gargles.* Oral remedies are employed for the purpose of preserving and restoring the normal equilibrium of the oral tissues, and consequently no specific pharmacologic action is represented by each class of these preparations—they represent merely a combination of medicinal agents indicated for a clinical entity. According to their therapeutic indications, the drugs used in the mouth are grouped under abrasives, antacids, antiseptics, astringents, stimulants, and correctives.

The preparations used for the mouth and teeth are conveniently divided into mouth washes, tooth powders, tooth pastes, and tooth soaps. Mouth pastils, cachous, and chewing gums are also used by the laity; they are intended to flavor the breath, and possess no medicinal value.

DRUGS USED IN PREPARATIONS FOR THE MOUTH AND TEETH.

In constructing a formula for a mouth or tooth preparation the following substances must be avoided:

1. Strong precipitants of albumen (concentrated alcohol, mineral acids, with the exception of boric acid, metallic salts, phenol and salicylic acid and most of their derivatives, etc.).
2. Caustics (potassium and sodium hydroxide and many of the potassium salts).
3. Strong astringents (formaldehyde solution, etc.).
4. Gritty substances (pumice stone, charcoal, crude chalk, etc.).
5. Fermentable substances (sugars, starches, vegetable powders).
6. Staining substances (organic and inorganic dyestuffs, chinosol, iron salts, manganese salts, etc.).

The following is a list of drugs which may be employed in mouth and tooth preparations, and their relative highest percentages in 100 parts of the finished product.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ABRASIVES.

Cuttlefish bone	3 to 5	per cent
Soap	2 to 3	"
Cinchona bark	5	"
Orris root	10	"
Calamus root	10	"
Calcium carbonate, precipitated, up to	100	"

ANTACIDS.

Sodium bicarbonate	5	per cent
Magnesium carbonate	10	"
Magnesium oxide	10	"
Calcium carbonate, precipitated, up to	100	"

ANTISEPTICS.

Mercuric bichloride	0.05 to 0.1	per cent
Benzoic acid	1 to 3	"
Sodium fluoride	1 to 3	"
Hydronaphtol	1 to 5	"
Resorcinol	1 to 5	"
Salol	3 to 5	"
Phenol	3 to 5	"
Potassium chlorate	1 to 5	"
Salicylic acid	3 to 5	"
Magnesium dioxide	5 to 10	"
Sodium perborate	5 to 10	"
Strontium dioxide	5 to 10	"
Boric acid	10 to 20	"
Sodium borate	10 to 20	"
Hydrogen dioxide solution	10 to 20	"

ASTRINGENTS.

Zinc chloride	0.05 to 0.1	per cent
Tannic acid	1 to 2	"
Benzoin	5	"
Catechu	5	"
Kino	5	"
Myrrh	5	"
Rhatany root	2 to 10	"

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

STIMULANTS.

Oil of rose	0.1 to 0.5	per cent
Oil of ylang-ylang	0.1 to 0.5	"
Menthol	0.5	"
Thymol	0.5	"
Eucalyptol	1	"
Oil of geranium	0.5 to 1	"
Oil of cinnamon	1	"
Oil of peppermint	1	"
Oil of clove	1 to 2	"
Oil of eucalyptus	1 to 2	"
Oil of mountain pine	1 to 3	"
Camphor	1 to 3	"
Oil of wintergreen	1 to 4	"
Methyl salicylate	1 to 5	"
Alcohol	10 to 100	"

CORRECTIVES.

Saccharin	0.0003	per cent
Cumarin	0.5 to 1	"
Vanilla	0.5 to 1	"
Glycerin	5 to 10	"

FLAVORING AGENTS.

Flavoring agents are represented principally by mixtures of essential oils. These oils should not haphazardly be compounded but selected according to their odoriferous relationship. A few agents, like tincture of vanilla, or of ambergris, are often employed in very small quantities as so-called fixatives of the respective odors. About 1 part of the oil mixture should be added to 100 parts of the finished product.

Suitable flavoring solutions may be made from the following groups; it is desirable to restrict the oil mixture to components of a single group.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Group I.

- Oil of peppermint
- Oil of spearmint
- Oil of wintergreen
- Oil of sweet birch
- Oil of mountain pine
- Oil of lemon
- Gum camphor

Group II.

- Oil of cinnamon
- Oil of cassia
- Oil of clove
- Oil of anise
- Oil of orange
- Oil of orris root

Group III.

- Oil of rose
- Oil of rose-geranium
- Oil of ylang-ylang
- Oil of cananga

Fixatives.

- Tincture of vanilla
- Tincture of ambergris
- Tincture of musk

The following oil mixture produces a serviceable flavoring combination:

Oil of peppermint	56 parts
Oil of eucalyptus	16 “
Methyl salicylate	12 “
Oil of lemon	10 “
Oil of anise	5 “

ACTION OF ANTISEPTICS IN THE MOUTH.

According to W. D. Miller.

DRUGS.	Dilution in which they can be employed in mouth.	Time in which the mouth becomes sterilized.
Acid benzoic	1: 100	¼ minute
Acid boric	1: 50	above 11 minutes
Acid salicylic	1: 300	¾ to 1 minute
Eugenol	1: 750	above 10 minutes
Hydronaphthol	1:1500	above 15 minutes
Iodine trichloride	1:2000	above 1¼ minutes
Lysol	1: 200	above 5 minutes
Mercuric chloride	2:2500	½ to ¾ minute
Oil of cinnamon	1: 400	about 8 minutes

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Oil of clove	1: 550	above 11 minutes
Oil of eucalyptus	1: 625	above 8 minutes
Oil of mountain pine	1: 360	above 19 minutes
Oil of peppermint	1: 600	above 11 minutes
Oil of wintergreen	1: 350	above 12 minutes
Phenol	1: 100	above 5 minutes
Potassium chlorate	1: 40	
Potassium permanganate	1:4000	about 15 minutes
Saccharin	1: 400	$\frac{3}{4}$ minute
Solution aluminum acetate	1: 20	above 5 minutes
Solution hydrogen dioxide	2: 100	above 6 minutes
Thymol	1:2000	above $5\frac{1}{2}$ minutes

MOUTH WASHES.

A mouth wash is usually prescribed as a gargle, to be used in conjunction with the toothbrush. The components of the wash should be so adjusted that one teaspoonful, mixed with a half tumblerful of warm water (approximately 1 to 30), furnishes the correct proportions of its active ingredients intended for daily use. The gargling motion is produced by forcing air from the lungs through the fluid held posteriorly in the open mouth. Powerful exercise of the muscles of the pharynx, the cheeks, and the lips are material adjuncts in forcing the fluid back and forth through the teeth. About one-half to one minute's gargling is the average time required for each mouthful, corresponding approximately to $\frac{1}{2}$ to 1 fluid ounce (15 to 30 cc) of liquid. Correct gargling is quite a difficult procedure; it cannot be accomplished by children and those afflicted with pharyngeal disturbances. Through incorrect gargling a quantity of the fluid is often swallowed, or it merely turns about in the anterior part of the mouth. If the fluids contain alcoholic or volatile liquids, more or less of it is always absorbed.

Tooth and mouth washes are usually dispensed in flint glass bottles stoppered with corks or metallic sprinkler tops. If the latter are used the contents of the bottle must not corrode the metallic top.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Colors for Mouth Washes.

Bright red	Tincture of cochineal
Reddish-brown	Tincture of cudbear
Brown	Caramel solution
Golden yellow	Tincture of saffron
Green	Chlorophyl solution

Alkaline Mouth Wash.

Sodium bicarbonate	30 parts
Sodium benzoate	20 "
Sodium borate	50 "
Menthol	6 "
Thymol	3 "
Eucalyptol	3 "
Alcohol	100 "
Glycerin	200 "
Water, enough to make	1000 "

General Directions for Preparing a Mouth Wash:

Dissolve the essential oils, eucalyptol, thymol, menthol or other alcohol-soluble substances in the alcohol; mix the glycerin and the water and add the water-soluble substances. Mix the two solutions, and, if turbid, add 20 parts of purified talc for each 1000 parts of the finished product. Shake occasionally, and let stand for a week. Filter through paper, returning the first portions of the filtrate until it passes through clear.

Anatherin Dentrifice.

Red sandalwood	20 parts
Guaiac wood	10 "
Myrrh	25 "
Cloves	15 "
Cinnamon	5 "
Oil of clove	1 part
Oil of cinnamon	1 "
Alcohol	1500 parts
Water	750 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Antiseptic Mouth Wash.

Boric acid	25 parts
Benzoic acid	1 part
Thymol	3 parts
Eucalyptol	5 "
Oil of wintergreen	5 "
Menthol	6 "
Glycerin	100 "
Alcohol	250 "
Water, enough to make	1000 "

Chinosol Mouth Wash.

Chinosol	1 part
Oil of peppermint	1 "
Water	40 parts
Alcohol	60 "

Eau de Botot.

Star anise seed	25 parts
Cinnamon, Ceylon	25 "
Cloves	25 "
Cochineal	10 "
Potassium bitartrate	5 "
Tannic acid	5 "
Balsam of Peru	5 "
Oil of peppermint	10 parts
Alcohol, diluted	1000 "

Hydrogen Dioxide Mouth Washes.

1.

Resorcinol	50 parts
Zinc chloride	$\frac{1}{3}$ part
Menthol	5 parts
Thymol	2 "
Eucalyptol	$\frac{1}{4}$ part
Camphor	$\frac{1}{4}$ part
Oil of wintergreen	$\frac{1}{2}$ "
Hydrogen dioxide solution	200 "
Alcohol	250 "
Water, enough to make	1000 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Thymol	$\frac{1}{2}$ part
Menthol	$\frac{1}{2}$ “
Saccharin	$\frac{1}{4}$ “
Alcohol	70 parts
Hydrogen dioxide solution	120 “

Miller's Mouth Washes.

1.

Thymol	1 part
Benzoic acid	12 parts
Tincture of eucalyptus	60 “
Alcohol	400 “
Oil of peppermint	3 “

2.

Benzoic acid	60 parts
Tincture of rhatany	260 “
Oil of peppermint	15 “
Alcohol, enough to make	2000 “

Pickerill's Acid Mouth Wash.

Potassium bitartrate	2 parts
Tartaric acid	2 “
Oil of lemon	3 “
Saccharin	$\frac{1}{4}$ “
Water	480 “

Pruyn's Mouth Wash.

Phenol	2 parts
Boric acid	6 “
Oil of cassia	2 “
Oil of peppermint	$\frac{1}{2}$ part
Chloroform	2 parts
Alcohol	50 “
Glycerin, enough to make	120 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Resorcinol Mouth Wash.

Boric acid	5 parts
Sodium borate	13 “
Resorcinol	18 “
Eau de cologne	100 “
Water, enough to make	500 “

Saccharin Mouth Wash.

Saccharin	½ part
Sodium borate	4 parts
Alcohol	50 “
Water	50 “
Tincture of cochineal	½ part
Oil of peppermint	1 “

Saponaceous Mouth Wash.

White Castile soap	25 parts
Oil of clove	10 “
Oil of peppermint	15 “
Oil of wintergreen	25 “
Oil of cassia	10 “
Glycerin	100 “
Water	600 “
Alcohol	400 “

Color with tincture of cochineal.

Thymol Mouth Wash.

Thymol	15 parts
Benzoic acid	10 “
Eucalyptol	30 “
Oil of peppermint	5 “
Oil of clove	1 part
Oil of sage	1 “
Cumarin	½ “
Alcohol, enough to make	1000 parts

Color with tincture of saffron.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Powder for Making a Mouth Wash.

Saccharin	12 parts
Menthol	15 "
Lime (calcium oxide)	150 "
Shaker salt	5760 "

The first two ingredients must be thoroughly triturated in a mortar, so as to obtain a fine powder. The lime is added, thoroughly mixed with it and finally the salt is added. The mixed powder should be passed through a coarse sieve so as to form a uniform mixture. If a color is desired, 1½ parts of phenolphthalein may be added.

Fifteen grains of this mixture added to 4 ounces of warm water makes a most suitable mouth wash for daily use.

TOOTH POWDERS.

Tooth powders, pastes and soaps are principally employed for the purpose of mechanically cleansing the accessible surface of the teeth. Their antiseptic effect on oral bacteria is of questionable value, as they remain hardly long enough in the mouth to enter into a complete solution. Tooth powders or pastes should not contain gritty or fermentable substances or corrosive chemicals which act deleteriously on tooth structure. The wasting away of tooth tissues, usually referred to as erosion or abrasion is largely the result of the continuous use of powders, pastes, etc., which contain more or less abrasive substances, as the late Miller has shown.

The materials which are principally employed in the manufacture of commercial tooth powders, pastes, and soaps are prepared chalk, precipitated calcium carbonate, magnesium carbonate, soap, pumice stone, cuttlefish bone, orris root, and many other substances—as vegetable powders of various kinds, borax, boric acid, potassium bitartrate, alum, charcoal, tin oxide, etc. Some of these substances possess a pronounced abrasive character, while others are polishing agents consisting of various degrees of grit.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

To insure absolute freedom from grit, all dry substances entering as components into a tooth powder or paste must be sifted through bolting cloth running 200 meshes to the linear inch.

The vegetable powders are principally used as adjuvants and diluents; their use in tooth powders is not to be encouraged, as they may lodge between the teeth, and the starch, which is present in most of these powders in variable quantities, may be the cause of acid fermentation.

An acquaintance with the physical nature of the ingredients entering into the makeup of tooth preparations in regard to their abrasive qualities is essential for the dental practitioner. A microscopic examination of the more important powdered substances, together with a comparative knowledge of their physical and chemical composition, furnishes excellent information regarding their usefulness as components of dentifrices.

Prepared chalk, drop chalk; whiting, a white amorphous powder, is crude calcium carbonate, purified by mechanical means. Prepared chalk is not precipitated chalk (calcium carbonate, precipitated). Prepared chalk contains in addition silica, alumina, and other impurities, and consists principally of the microscopic shells of many forms of infusoria. The minute particles of prepared chalk are sufficiently hard and sharp to remove tooth substance when used in a dentifrice, and should therefore never be employed for such purposes.

Precipitated chalk, precipitated calcium carbonate, is a fine white amorphous powder, prepared by chemical means. Depending upon the process of manufacture, various grades of fineness, weight, and color are obtained. For the purpose of preparing tooth powders, pastes, etc., only the very finest bolted precipitated calcium carbonate is permissible.

Prepared oyster shells are prepared from the boiled, cleansed, and powdered shells of the oyster. They consist principally of an impure calcium carbonate, with variable quantities of calcium phosphate, and small amounts of

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

iodine, bromine, organic matter, etc. The powder usually emits a peculiar sea odor. The abrasive power of powdered oyster shells is about equal to that of prepared chalk, and the same objection is raised to their use as a tooth powder base.

Pumice stone is a light, porous stone of volcanic origin, consisting chiefly of silica, with potash and soda. As may be expected from its composition, it is a powerful abrasive, and it should never enter into a tooth preparation intended for daily use. Even its temporary use in conjunction with precipitated chalk acts deleteriously on tooth structure.

Magnesium carbonate. Two forms of magnesium carbonate are known—the light and the heavy. The light preparation is usually employed for tooth powder purposes. It has no abrasive or polishing action on tooth structure. As it is a voluminous powder, it is principally used to give bulk to tooth powders. Burnt magnesia is prepared from magnesium carbonate by calcination. It possesses no advantage over magnesium carbonate, and is rarely used at present as a component of dentifrices.

Tin oxide, also known as flowers of tin or as putty powder, a white, amorphous practically insoluble powder is used by many manufacturers as a component of tooth powders to produce a high luster to the teeth.

Cuttlefish bone is a calcareous substance found under the skin of the back of the cuttlefish. It is composed of calcium carbonate, calcium phosphate, gluten, and other substances which are readily recognized by their peculiar putrid odor. The external hard skin and the internal soft deposits of the cuttlefish bone are ground together, forming a powder, which is used as an abrasive.

Charcoal is a very fine black powder prepared from soft wood (linden wood). It is odorless and tasteless, and, when freshly prepared, readily absorbs offensive odors. Even the finest charcoal powder presents a mass of sharp crystalline cylinders under the microscope, which possess marked abrasive power. When used as a component in a tooth powder, the sharp particles imbed themselves in due time in the gum

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

tissue, producing a distinct bluish line near the margin. The gum tissue becomes tatooed by the charcoal, and nothing can remove this pigmentation but a surgical operation. Charcoal should not be used in a tooth preparation; it is often found in the so-called Chinese and Japanese tooth powders.

Soaps.—Soaps must be used very sparingly in oral cosmetics. A good tooth preparation should not contain more than 2 to 3 per cent of the best quality of Castile soap. Many of the commercial preparations, especially tooth pastes and, naturally, tooth soaps, contain by far too large quantities of soap. Soaps are either potassium or sodium oleates; they are strong astringents and, in concentrated solutions, caustics. If used in concentrated form, they have a tendency of lowering the resistance of mucous linings of the oral cavity by maceration. Even the so-called neutral soaps (which do not exist, however), when employed in concentration above 4 per cent, invariably destroy the important salivary ferments. Soaps are employed in tooth preparations for the purpose of emulsifying food débris, precipitated mucin, freshly deposited tartar, etc., adhering to the tooth surfaces. The churning up of the abrasive, usually precipitated chalk, present as a base in most of the tooth powders and pastes, plus the foam produced by the soap, brush and water, mechanically remove these adhesions. If a strong emulsifying agent is desired in combination with a tooth preparation, the official tincture of quillaja may be employed. When used in conjunction with warm water, soap acts as a mild antiseptic.

Powdered vegetable drugs—as the roots of calamus, rhatany, licorice, and orris, cinchona bark, sandalwood, myrrh, benzoin, etc.—have no place in tooth powders. As stated above, they are added to give flavor to the powder or to increase its bulk. The odor and taste of these vegetable substances is readily substituted by their respective essential oils or alcoholic extracts. The short time in which a tooth powder remains in the mouth is not long enough to allow the active constituents of these substances to enter into

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

solution. Their abrasive action is of no value, but, as these vegetable powders may be forced between the teeth and remain there for some time, their starch constituent may give rise to acid fermentation.

Tooth powders are preferably dispensed in glass bottles or tin cans with suitable sprinkler tops.

BODIES FOR COLORED TOOTH POWDERS.

Red.

Carmin No. 40	20 parts
Ammonia water	50 "
Water	20 "
Alcohol	30 "
Calcium carbonate, precipitated	1000 "

Dissolve the carmin in the ammonia water, add the water and alcohol, and mix thoroughly with the calcium carbonate. Spread on paper and dry at room temperature; rub through a No. 100 brass wire sieve.

Pink.

Prepare same as red body, using only one-half of the carmin, 10 parts.

Violet.

Alkanet extract	2½ parts
Ether	100 "
Calcium carbonate, precipitated	1000 "

Prepare same as red body.

Camphor or English Tooth Powder.

Calcium carbonate, precipitated	750 parts
Magnesium carbonate	120 "
Sugar of milk	130 "
Camphor	20 "
Ether	30 "

Dissolve the camphor in the ether, mix with the calcium carbonate, dry in the air, and mix with the other ingredients.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Fitzgerald's Tooth Powder.

Calcium carbonate, precipitated	360 parts
Magnesium carbonate	300 "
Castile soap	150 "
Salol	60 "
Boric acid	30 "
Thymol	2 "
Saccharin	½ part
Oil of peppermint	5 parts

Harlan's Tooth Powder.

Calcium carbonate, precipitated	100 parts
Orris root	100 "
Castile soap	25 "
Sodium bicarbonate	25 "
Myrrh	100 "
Oil of wintergreen	10 "

Head's Tooth Powder.

Magnesium peroxide	60 parts
Sodium perborate	30 "
Castile soap	10 "

Flavoring to suit.

Lassar's Tooth Powder.

Calcium carbonate, precipitated	100 parts
Sodium chloride	2½ "
Pumice stone	2½ "
Castile soap	3 "
Oil of peppermint	1 part

Oxidizing Tooth Powder.

1.

Calcium carbonate, precipitated	75 parts
Magnesium carbonate	10 "
Sodium perborate	10 "
Castile soap	3 "
Oil of peppermint	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Calcium carbonate, precipitated	90 parts
Strontium dioxide	8 "
Castile soap	3 "
Oil of wintergreen	1 part
Oil of peppermint	$\frac{1}{2}$ "

Miller's Tooth Powder.

Calcium carbonate, precipitated	30 parts
Magnesium carbonate	10 "
Orris root	15 "
Oil of peppermint	$\frac{2}{3}$ part

Philadelphia Dental Dispensary Tooth Powder.

Calcium carbonate, precipitated	95 parts
Castile soap	3 "
Saccharin	$\frac{1}{8}$ part
Oil of birch	1 "
Oil of peppermint	$\frac{1}{2}$ "

Rhein's Tooth Powder.

Calcium carbonate	32800 parts
Oil of peppermint	410 "
Oil of gaultheria	820 "
Sodium bicarbonate	2800 "
Sodium oleate	2800 "
Potassium bitartrate	5600 "
Saccharin	1 part

TOOTH PASTES.

A perfect tooth paste cannot be produced satisfactorily without the use of some "binding" agent. The most serviceable excipient is powdered tragacanth. Pastes which are massed with pure glycerin only are disappointing; the latter oozes from the tube, discoloring the label and forming

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

an unsightly package. Glycerin is necessary, but it should not be employed alone. Glucose should never be used as a massing fluid, as it will easily ferment. The consistency of the excipient or massing fluid determines the character of the paste.

Massing Fluids.

Powdered gum tragacanth	2 parts
Glycerin	50 "
Water	50 "

Dissolve the gum tragacanth in the water-glycerin mixture.

Another massing fluid is made by mixing:

Glycerin	2 parts
Mucilage of acacia	2 "

Mucilage of acacia is made by dissolving:

Gum arabic	2 parts
Water	3 "

Dissolve the gum arabic in the water, and strain through a fine cotton cloth.

Tooth pastes may be prepared according to this general formula:

Tooth powder body	10 parts
Massing fluid	7 to 10 "

Tooth pastes are best dispensed in collapsible tubes of pure tin.

Albodon Dental Cream.

Calcium carbonate	29.41 parts
Castile soap	26.05 "
Water	7.00 "
Essential oils	3.74 "
Glycerin	16.99 "
Alcohol	16.05 "
Benzoic acid Saccharin	0.76 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

“Common Sense” Tooth Paste.

Gum tragacanth, powder	½ part
Castile soap, powder	5 parts
Distilled water	20 “
Glycerin	20 “
Flavoring oils	1 part
Calcium carbonate, precipitated	54 parts

English Cherry Tooth Paste.

Pumice, powder	750 parts
Orris root, powder	1000 “
Calcium carbonate, precipitated	2500 “
Gum tragacanth, powder	15 “
Oil of clove	60 “

Mix intimately and add

Morella cherry juice	1250 parts
Glycerin	1000 “
Solution of cochineal	240 “
Mucilage of gum arabic	240 “

English Odontine.

Calcium carbonate, precipitated	500 parts
Orris root	100 “
Pumice stone	50 “
Oil of peppermint	10 “
Oil of sage	5 “
Oil of clove	2 “

Carmin, enough to color.

Massing fluid, enough to make a paste.

Kaladont.

Calcium carbonate, precipitated	250 parts
Magnesium carbonate	80 “
Castile soap	100 “
Oil of peppermint	10 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Oil of clove	2 parts
Oil of cinnamon	1 part
Oil of wintergreen	1 “

Carmin, enough to color.

Massing fluid, enough to make a paste.

Kolynos Dental Cream.

Calcium carbonate	21.00 parts
Castile soap	25.50 “
Thymol	.25 part
Benzoic acid	.30 “
Saccharin	.50 “
Oil of eucalyptus	1.75 parts
Oil of peppermint	1.90 “
Glycerin	27.00 “
Alcohol	21.80 “

Miller's Tooth Paste.

Calcium carbonate, precipitated	100 parts
Magnesium carbonate	5 “
Cuttlefish bone	4 “
Sugar	2 “
Myrrh	2 “

Massing fluid, enough to make a paste

Pepsodent.

Pepsin	0.621 parts
Acid calcium phosphate	0.512 “
Calcium chloride	0.237 “
Mitigated calcium phosphate	57.834 “
(Tricalcium phosphate.)	
(Anhydrous calcium sulphate.)	
Glycerin Alcohol Water Flavoring	40.796 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Potassium Chlorate Tooth Paste.

Calcium carbonate, precipitated	350 parts
Orris root	100 “
Potassium chlorate	250 “
Oil of peppermint	5 “
Oil of clove	2 “
Oil of wintergreen	1 part

Massing fluid, enough to make a paste.

Saline Tooth Paste.

Artificial Carlsbad salt	1 part
Powdered Castile soap	1 “
Calcium carbonate, precipitated	3 parts

Massing fluid, enough to make a paste.

Salol Tooth Paste.

Precipitated calcium carbonate, heavy	350 parts
Powdered orris root	150 “
Sugar of milk	100 “
Powdered Castile soap	50 “
Salol	20 “
Oil of peppermint	5 “
Oil of clove	3 “

Massing fluid, enough to make a paste.

HARD TOOTH PASTES OR TOOTH SOAPS.

Tooth soaps are usually prepared by incorporating about 20 per cent of Castile soap in an alcoholic solution into the powder base and pressing the mass into suitable moulds; their hardness increases with age. Tooth soaps are usually dispensed in flat tin boxes, china jars, or wrapped in tin foil.

Austrian Tooth Soap.

Castile soap	200 parts
Calcium carbonate, precipitated	80 “
Carmin	2 “
Oil of peppermint	5 “
Alcohol	30 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Bergmann's Tooth Soap.

Transparent glycerin soap	50 parts
Sugar	25 “
Alcohol	20 “
Water	10 “
Oil of peppermint	1 part

Kobert's Tooth Soap.

Magnesium carbonate	50 parts
Orris root	50 “
Talcum	50 “
Castile soap	50 “
Oil of wintergreen	3 “

Thymol Tooth Soap.

Pink tooth powder body	750 parts
Castile soap	200 “
Glycerin	50 “
Alcohol	100 “
Thymol	10 “
Cumarin	$\frac{1}{2}$ part
Menthol	10 parts
Oil of clove	5 “

Dissolve the thymol, cumarin, menthol and oil of clove in the alcohol, add the glycerin and soap, and, after complete solution, incorporate the tooth powder body. Press in suitable moulds, expose to the air for twenty-four hours and paint the pieces with tincture of benzoin to give a gloss to the finished product.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER VII.

PHARMACEUTICAL COMPOUNDS

LOCAL ANESTHETIC SOLUTIONS.

1.—Fischer.

Novocaine	2	parts
Sodium chloride	0.92	part
Thymol	0.02	"
Distilled water, enough to make	100	parts

Boil and filter.

To each 16 drops of this solution add 1 drop of adrenalin chloride solution when needed.

2.—Normal.

Novocaine	1.5	parts
Potassium sulphate, C. P.	0.4	part
Sodium chloride, C. P.	0.7	"
Distilled water, enough to make	100	parts

Boil and filter.

To each 16 drops of this solution add 1 drop of adrenalin chloride solution when needed.

3.—Schleich (Strong).

Cocaine hydrochloride	0.2	part
Sodium chloride	0.2	"
Morphine hydrochloride	0.02	"
Distilled water, enough to make	100	parts

4.—Schleich (Medium).

Cocaine hydrochloride	0.1	part
Sodium chloride	0.2	"
Morphine hydrochloride	0.02	"
Distilled water	100	parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

5.—Schleich (Weak).

Cocaine hydrochloride	0.01 part
Sodium chloride	0.2 "
Morphine hydrochloride	0.005 "
Distilled water	100 parts

6.

Cocaine hydrochloride	5 parts
Sodium chloride	4 "
Sterile water	480 "

To each 16 drops of this solution add 1 drop of adrenalin chloride solution, when used.

7.—Peeso.

Phenol, liquid	10 parts
Cocaine hydrochloride	10 "
Atropine sulphate, 2 per cent solution	10 "
Nitroglycerin, 1 per cent solution	10 "
Adrenalin chloride solution	10 "
Distilled water, enough to make	1000 "

8.—Wyckoff.

Cocaine hydrochloride	4 parts
Solution trinitrin (1 per cent)	10 "
Spirit thymol comp.	120 "
Distilled water, enough to make	480 "

P. S.—Spirit thymol comp. is composed of benzo-boric acid, thymol, eucalyptol, oil of wintergreen, oil of peppermint, with extract of witch-hazel, alcohol, and distilled water.

TROPACOCAINE ANESTHETIC SOLUTION.

Tropacocaine hydrochloride	20 parts
Sodium chloride	5 "
Distilled water	480 "

Boil and filter.

Do *not* add adrenalin chloride to a tropacocaine solution.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

MODIFIED RINGER SOLUTION.

Fischer.

Sodium chloride	0.5 part
Calcium chloride	0.04 “
Potassium chloride	0.02 “
Distilled water	100 parts

Boil and filter.

PHYSIOLOGICAL SALINE SOLUTION.

Tablet sodium chloride ($16\frac{2}{5}$ grs.)	1 tablet
Distilled water	4 fl. ounces

Boil and filter.

QUANTITIES OF ADRENALIN SOLUTION TO BE ADDED TO A 1½ TO 2 PER CENT NOVOCAINE SOLUTION.

Add 1 drop of adrenalin solution to 1 cc of the novocaine solution.

Add 2 drops of adrenalin solution to 3 cc of the novocaine solution.

Add 3 drops of adrenalin solution to 5 cc of the novocaine solution.

Add 4 drops of adrenalin solution to 8 cc of the novocaine solution.

Add 5 drops of adrenalin solution to 10 or more cc of the novocaine solution.

NOVOCAINE COMPOUND TABLETS.

Novocaine	$\frac{1}{3}$ grain
Suprarenin hydrochloride	1200 “

One tablet dissolved in 16 drops of sterile physiological saline solution by boiling makes a 2 per cent solution of novocaine ready for immediate use.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

HEMOSTATIC LOCAL ANESTHETIC SOLUTION.

Le Grand.

Gelatin	2	parts
Sodium chloride	0.7	part
Phenol crystals	0.1	"
Eucaine B.	0.7	"
Cocaine hydrochloride	0.3	"
Distilled water, enough to make	100	parts

TO RELIEVE PAIN AFTER EXTRACTION.

1.

Menthol	2	parts
Phenol, liquid	2	"
Tincture of iodine	2	"
Ether	30	"
Chloroform	30	"

Apply on cotton to the painful alveolar socket.

2.

Orthoform powder	1	part

Roll absorbent cotton into a cone, dip in carbolated water, and cover with orthoform powder; insert the cone into the painful alveolar socket.

LOCAL ANESTHETIC FOR SCALING OF THE TEETH.

1.

Phenol, liquid	10	parts
Cocaine hydrochloride	10	"
Menthol	25	"
White vaseline	480	"

Before scaling the teeth, rub the paste into the spaces between the teeth and on the gum.

2.

Cocaine hydrochloride	20	parts
Oil of clove	8	"
Oil of cassia	8	"
Menthol	8	"
Chloroform	480	"

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Before removing deposits from roots, saturate a pellet of cotton with the solution, crowd gently into pockets, and allow to remain for a few moments.

EUROFORM PASTE.

Buckley.

Orthoform	60 parts
Europhen	90 "
Petronol	135 "
Petrolatum	125 "

LOCAL ANESTHETIC COMPOUNDS FOR EXPOSED DENTAL PULPS.

1.—Gertzen.

Sodium bicarbonate	10 parts

Phenol, liquid, enough to make a creamy paste.

2.—Pincemaille.

Cocaine hydrochloride	1 part
Chloroform	5 parts
Phenosalyl	25 "
Oil of lavender	10 "
Oil of clove	20 "
Oil of cinnamon	25 "

3.

Chloretone	150 parts
Oil of clove	450 "

COMPOUNDS FOR DEVITALIZING THE DENTAL PULP.

Arsenical Pastes.

1.

Arsenic trioxide	20 parts
Cocaine hydrochloride	10 "

Glycerin, enough to make a paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Arsenic trioxide	1 part
Orthoform	1 “

Lanolin, enough to make a paste.

3.

Arsenic trioxide	20 parts
Cocaine hydrochloride	20 “
Menthol	5 “

Glycerin, enough to make a paste.

4.

Arsenic trioxide	20 parts
Thymol	20 “

Oil of clove, enough to make a paste.

5.

Arsenic trioxide	90 parts
Cocaine hydrochloride	40 “
Phenol crystals	10 “

Lanolin, enough to make a paste.

6.

Arsenic trioxide	5 parts
Tannic acid	2 “
Morphine acetate	10 “

Oil of clove, enough to make a paste.

7.

Crude cobalt	80 parts
Cocaine hydrochloride	20 “

Phenol, liquid, enough to make a paste.

8.—Arsenical Fiber.

Arsenic trioxide	5 parts
Tannic acid	2 “
Morphine acetate	10 “

Phenol, liquid, enough to make a thin paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Mix with sufficient fine cross-cut absorbent cotton fibers until the paste is completely absorbed; dry, and keep in a well-covered glass jar.

9.—Arsenical Disks.

Arsenic trioxide	10 parts
Cocaine hydrochloride	10 "

Oil of clove, enough to make a soft paste.

Cut small squares (1 to 1½ millimeters) of hard white blotting paper, saturate with the paste, let dry, and then put into a glass-stoppered bottle.

DENTAL PULP DIGESTANT.

Harlan.

Papain	1 part
Glycerin	1 "
Solution hydrochloric acid (1:100)	1 "

Make a paste, apply to the dead pulp, and seal into the cavity for two weeks, at the end of which time the pulp will be digested. The pulp must be first destroyed by arsenic left in the tooth for two or three days. Remove the arsenic, cut away the bulbous portion of the pulp, and introduce the paste as above. The pulp is reduced to a jelly-like mass, and is now easily removed.

STYPTICS.

Styptic Cotton.

1.

Solution of iron chloride	80 parts
Glycerin	16 "
Water	225 "
Purified cotton	100 "

Mix the solution of ferric chloride, glycerin and water, immerse the purified cotton in this solution, and allow it to remain one hour. Then remove it, press it and spread it out in thin layers, in a warm place protected from dust and light. When dry transfer it to well-closed glass containers.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Solution of iron chloride	60 parts
Alcohol	60 “

Mix and saturate

Absorbent cotton	40 parts

Dry in a dark closet and preserve in dark colored glass jars.

Styptic Mixture.

Phenol-sulphonic acid	12 parts
Alcohol	4 “
Benzoic acid	1 part
Tannic acid	1 “
Glycerin	12 parts
Rose water	56 “

For external use.

Styptic Collodion.

Tannic acid	20 parts
Flexible collodion	80 “

BONE CAVITY PASTES.

1.—Bone Plombe; Mosetig-Mayrhofer.

Iodoform	10 parts
Oil of sesame	15 “
Spermaceti	30 “

Melt the spermaceti and the oil of sesame in a porcelain capsule over a low flame, and when the mixture starts to congeal, stir in the iodoform.

2.—Bismuth Paste; Beck.

(a) Soft Paste.

Bismuth subnitrate	33 parts
Vaseline (yellow or white)	67 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

(b) Hard Paste.

Bismuth subnitrate	30 parts
Vaseline	60 “
Paraffin (melting point 120° F.)	5 “
White wax	5 “

Place the vaseline, paraffin and white wax in an enamelled vessel, bring to a boil, and add the bismuth under constant stirring until the paste becomes solid.

3.—Horsley Bone Putty.

Phenol crystals	1 part
Olive oil	2 parts
Beeswax	7 “

BISMUTH PASTE.

Morison.

Bismuth subnitrate	1 part
Iodoform	2 parts

Paraffin oil (Nujol) enough to make a thick paste.

BLACK SILVER NITRATE OINTMENT.

Williger.

Silver nitrate	1 part
Balsam of Peru	10 parts
Vaseline	90 “

RESORCIN PASTE.

Lassar.

Resorcin	10 parts
Zinc oxide	25 “
Cornstarch	25 “
Liquid paraffin	40 “

ZINC PASTE.

Lassar.

Salicylic acid	2 parts
Zinc oxide	25 “
Cornstarch	25 “
Vaseline	50 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PLASTIC INJECTION FOR PYORRHEA POCKETS.

Menthol	3 parts
Hydronaphthol	15 "
White wax	240 "
Vaseline	480 "

SEAL FOR PYORRHEA POCKETS.

1.—Rhein.

Gum lac, purified	135 parts
Gum benzoin, purified	5 "
Phenol crystals	50 "
Oil of cinnamon	3 "
Saccharin	3 "
Alcohol, enough to make	500 "

After the removal of all deposits and the application of a stimulating escharotic, covering with this soothing application will keep the pockets sealed for many hours, and will be found beneficial from its therapeutic properties.

2.—Steresol.

Gum shellac	270 parts
Gum benzoin	10 "
Balsam of Tolu	10 "
Phenol crystals	100 "
Oil of cinnamon	6 "
Saccharin	6 "
Alcohol, enough to make	1000 "

3.—Mastisol.

Gum mastic	20 parts
Chloroform	50 "
Linseed oil	1 part

4.—Whitehead.

Balsam of Tolu	1 part
Styrax	3 parts
Gum benzoin	4 "
Ether	40 "
Iodoform	4 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

SURGICAL DUSTING POWDERS.

1.

Bismuth subgallate	20 parts
Talc	70 “
Cornstarch	10 “

2.

Salicylic acid	1 part
Boric acid	24 parts
Talc	225 “

3.

Borax powder	2 parts
Zinc peroxide	3 “
Boric acid	5 “

4.

Alum	1 part
Bismuth subgallate	2 parts
Zinc phenol-sulphonate	2 “
Sodium perborate	5 “
Zinc oxide	40 “
Boric acid	50 “

5.

Salicylic acid	7½ parts
Phenol crystals	1½ “
Eucalyptol	1½ “
Menthol	1½ “
Thymol	1½ “
Zinc sulphate	2 “
Boric acid, impalpable powder	18 “

COUNTER-IRRITANTS.

1.—Iodo-glycerol; Talbot's.

Zinc iodide	15 parts
Distilled water	10 “
Iodine	25 “
Glycerin	50 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dissolve the zinc iodide in the distilled water, add the iodine, stir with a glass rod until dissolved, and, lastly, add the glycerin.

2.—Compound Iodine Solution; Harlan's

Iodine crystals	24 parts
Potassium iodide	24 "
Tincture of aconite root, Fleming's	12 "
Alcohol	48 "
Chloroform	48 "

3.—Compound Iodine Solution; Younger's.

Solution 1.

Zinc sulphate	5 parts
Distilled water	5 "

Solution 2.

Potassium iodide	2 parts
Iodine crystals	2 "
Distilled water	8 "

Mix equal parts of solution 1 and 2, and let stand for two weeks until the freshly formed potassium sulphate is crystallized out. Decant the supernatant solution of zinc iodide.

4.—Pyorrhea Astringent; Buckley.

Potassium iodide	60 parts
Iodine crystals	80 "
Zinc phenosulphonate	60 "
Water	190 "
Glycerin	100 "

5.—Aromatic Tincture of Iodine and Aconite; Witzel.

Eugenol	3 parts
Eucaine	5 "
Tincture of aconite	32 "
Tincture of iodine	65 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Stronger Tincture of Aconite.

(For external use only).

Fluid extract aconite root	2 parts
Alcohol	2 “

Iodine Paint; Carson.

Iodine crystals	1 part
Alcohol	8 parts

Iodine Caustic; Churchill.

Iodine crystals	35 parts
Potassium iodide	70 “
Water	150 “

Stable Tincture of Iodine.

Iodine crystals	1 part
Alcohol	12 parts
Sodium borate	2 “

Decolorized Tincture of Iodine.

Iodine crystals	20 parts
Sodium thiosulphate	20 “
Distilled water	20 “

Put the ingredients in a bottle and place the bottle in a vessel surrounded by cold water. Shake occasionally until solution is completed. Add in small portions:

Ammonia water	32 parts
Alcohol	150 “

Let stand for eight days and filter.

Skinner's Disclosing Solution.

Iodine crystals	5 parts
Potassium iodide	1½ “
Zinc iodide	1½ “
Distilled water	25 “
Glycerin	25 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Modified Disclosing Solution.

Potassium iodide	12 parts
Iodine crystals	12 “
Distilled water	100 “
Glycerin	100 “

Refrigerant Counter-irritant; Buckley.

1.

Menthol	10 parts
Iodine crystals	10 “
Chloroform	75 “
Tincture of aconite, U. S. P.	375 “

2.

Chloroform	3 parts
Tincture of aconite	5 “
Tincture of iodine	10 “

Chloroform Liniment.

Gum camphor	6 parts
Ether	12 “
Alcohol	48 “
Chloroform	100 “

For external use only.

Dental Liniment; Buckley.

Menthol	20 parts
Chloroform	75 “
Tincture of aconite, U. S. P., enough to make	480 “

For external use only.

Dental Liniment; Hoff.

Menthol	4 parts
Spirit of camphor	4 “
Chloroform	8 “
Ether	8 “
Spirit of rosemary	8 “
Ammonia water	20 “
Tincture of capsicum	20 “

For external use only.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Capsicum Plaster.

Caoutchouc	10 parts
Paraffin	1 part

Heat carefully until just liquefied, and add under constant stirring.

Rosin	10 parts
Orris root, powdered	4 “
Capsicum, powdered	4 “

Spread thinly on linen and after trying, cut in small pieces. Dry the gum thoroughly before applying.

Capsicum Bags.

Powdered capsicum	2 parts
Powdered ginger	2 “

Fill small muslin bags with the mixture and cover one side with rubber dam. The muslin side of the bag is placed against the gum.

Balsam Analgésique; Bengué.

Menthol	18 parts
Methyl salicylate	20 “
Lanolin	55 “
Lard	8 “

ANTISEPTIC COMPOUNDS.

Iodine Caustic.

Iodine crystals	1 part
Creosote	3 parts

Phenol Compound; Buckley.

Menthol	1 part
Thymol	2 parts
Liquid phenol	9 “

Camphorated Phenol.

1.

Phenol crystals	3 parts
Camphor	6 “
Alcohol	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Phenol crystals	2 parts
Camphor	4 “
Liquid petrolatum	4 “

Iodized Phenol.

Iodine crystals	2 parts
Phenol, liquid	6 “
Glycerin	2 “

Phenosalyl.

Menthol	1 part
Eucalyptol	5 parts
Salicylic acid	10 “
Lactic acid	20 “
Phenol crystals	90 “

Solution of Sodium Phenolate.

Phenol crystals	7 parts
Sodium hydroxide solution (5 per cent)	10 “
Water	83 “

Dissolve the sodium hydrate in the water, add the phenol and warm gently.

Compound Solution of Cresol.

Soft soap (U. S. P.)	350 parts
Distilled water	150 “

Place on a water-bath and stir until homogeneous and add

Cresol (U. S. P.)	500 parts

Stir until liquefied.

Saponated Tincture of Cresol.

Cresol	350 parts
Soft soap	450 “
Alcohol, enough to make	1000 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Eucalyptol Compound.

1.

Camphor	1 part
Phenol	1 “
Oil of eucalyptus, enough to make	10 parts

2.—Buckley.

Menthol	64 parts
Thymol	96 “
Eucalyptol, enough to make	2000 “

Thymophene.

Phenol crystals	2 parts
Thymol	2 “

Place the thymol in a dry bottle, melt the phenol and pour it over the thymol. The resultant solution will remain liquid.

Thymocamphene.

Phenol crystals	2 parts
Thymol	1 part
Camphor	1 “

Place the thymol and the camphor in a dry bottle, melt the phenol and pour it over the mixture. The resultant solution will remain liquid.

Geranium-Formol.

Formaldehyde solution	40 parts
Oil of geranium	20 “
Alcohol	40 “

Formocresol; Buckley.

Tricresol	2 parts
Formaldehyde solution	2 “

1-2-3 Mixture; Black.

Oil of cassia	1 part
Phenol crystals	2 parts
Oil of wintergreen	3 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dichloramine-T Solution; 5 Per Cent.

Dichloramine-T	5 parts
Chlorcosane	100 "

Place the dichloramine-T in a clean and dry test-tube; add a few drops of chloroform, shake, and now add the chlorcosane; plug with cotton and place the tube upright in a sand-bath, and apply heat—within a quarter of an hour complete solution usually results—the heat of the sand-bath must never be above 200° F. When cool, transfer to a brown office preparation bottle with glass cover.

Solution of Chlorinated Soda Compound; Lepkowsky.

(For the treatment of infected root canals.)

Solution of chlorinated soda	9 parts
Solution of sodium hydroxide	1 part

Compound Chloral Solution; Baumgartner.

(For the treatment of infected root canals.)

Chloral hydrate	50 parts
Water	25 "
Dilute hydrochloric acid	25 "

Mono-chlor-phenol Compound.

(For the treatment of infected root canals.)

Thymol	1 part
Mono-chlor-phenol	3 parts
Potassium hydroxide	1 part

Melt the thymol and the mono-chlor-phenol in a test-tube and add to it the potassium hydroxide. Carefully heat over a low Bunsen flame until a perfect solution is obtained. Immediately transfer to small, perfectly dry bottles and protect with a paraffined stopper.

Phenol-sulphonic Acid.

Phenol, liquid	45 parts
Sulphuric acid, strong	40 "

Heat to about 150° F. for several days and add

Distilled water, enough to make	100 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Mercuric Bichloride Solution.

Bernays' antiseptic tablet	1 tablet
Solution of hydrogen dioxide	4 fl. ounces

Antiseptic Solution; Dobell.

Sodium borate	240 parts
Sodium bicarbonate	240 “
Phenol, liquid	48 “
Glycerin	480 “
Water, enough to make	15,000 “

Antiseptic Solution; Thiersch.

Salicylic acid	4 parts
Boric acid	12 “
Water	1000 “

EXTEMPORANEOUS SOLUTIONS OF HYDROGEN PEROXIDE.

Extemporaneous solutions of hydrogen peroxide may be prepared as follows:

2 Per Cent (by volume) Solution.

Sodium perborate	25 parts
Boiling distilled water, enough to make	1000 “

Filter, if necessary.

5 Per Cent (by volume) Solution.

Sodium perborate	65 parts
Tartaric, or citric acid, powdered	21 “
Boiling distilled water, enough to make	1000 “

Filter, if necessary.

10-12 Per Cent (by volume) Solution.

Sodium perborate	170 parts
Tartaric, or citric acid, powdered	60 “
Boiling distilled water, enough to make	1000 “

Filter, if necessary.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

18-20 Per Cent (by volume) Solution.

Sodium perborate	210 parts
Tartaric, or citric acid, powdered	105 “
Boiling distilled water, enough to make	1000 “

Filter, if necessary.

These aqueous solutions of sodium perborate produce a hydrogen peroxide solution which always reacts alkaline.

To Preserve Hydrogen Peroxide Solution.

Solution hydrogen peroxide	1000 parts
Acetanilid	1 part

Keep in well-stoppered bottles.

Black Zinc Chloride Solution; Witzel.

Zinc chloride	10 parts
Phenol, liquid	5 “
Alcohol	5 “
Chloroform	1 part
Oil of peppermint	1 “
Oil of clove	1 “

Aromatized Iodoform.

Iodoform	96 parts
Cumarin	4 “

Iodoform Emulsion.

Iodoform	5 parts
Mucilage of gum arabic	2½ “
Glycerin	15 “
Water, enough to make	60 “

Iodoform Wax.

Iodoform	1 part
Hard paraffin	1 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid Iodoform.

Potassium hydroxide	35 parts
Water	25 "
Oleic acid	50 "
Alcohol, 95 per cent	30 "
Iodine	30 "

Dissolve the potassium hydroxide in the water, then pour the oleic acid and alcohol into this solution of potassa. With continued stirring add the iodine, and, finally, a few drops of potassium hydroxide solution to discharge the reddish color of the liquid. Let the mixture stand for several days in a dark place, when it will separate into well-defined layers. The upper aqueous layer is decanted. The lower layer is a syrupy liquid, having a pronounced yellow color and a strong odor of iodoform.

Aristol Oil Solution.

Aristol	1 part
Oil of sesame	9 parts

Mix and let stand undisturbed for one-half hour. Then repeatedly shake during the next ten hours, set aside for three or four days and pour off the clear solution.

Neutral Sodium Hypochlorite Solution.
Dakin.

Sodium carbonate, crystals	40 parts
Bleaching powder (24 to 28 per cent chlorine)	20 "
Boric acid	4 "
Water	1000 "

Add the sodium carbonate and the bleaching powder to the water; shake well and let stand for one hour. Filter through a cotton plug and add the boric acid. The solution should not be kept longer than one week.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Burrow's Solution.

Lead acetate	150 parts
Aluminum sulphate	85 “
Water, enough to make	1000 “

Dissolve each salt in 500 parts of water and mix the cold solutions by pouring the lead acetate solution in a thin stream, with constant stirring, into the aluminum sulphate solution. Shake occasionally and after twenty-four hours pour off the clear liquid.

Solution of Aluminum Acetate.

Aluminum sulphate	300 parts
Acetic acid	300 “
Precipitated calcium carbonate	138 “
Water, enough to make	1000 “

Dissolve the aluminum sulphate in about 900 parts of water, filter the solution and gradually add the calcium carbonate with constant stirring. Slowly add the acetic acid and set the mixture aside for several days, shaking occasionally. Pour off the *clear* solution only and add enough water to make 1000 parts of the finished product.

ROOT CANAL FILLING MATERIALS.

1.—Scheurer.

Eugenol	1 part
Formaldehyde solution	1 “
Cresol	3 parts
Zinc sulphate	2 “
Zinc oxide	8 “

Glycerin, enough to make a stiff paste.

2.

Zinc sulphate	75 parts
Zinc oxide	225 “
Oil of peppermint	1 part

Lysoform, enough to make a paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Iodoform	90 parts
Zinc oxide	45 “
Charcoal, powdered	45 “

Oil of clove, enough to make a paste.

4.

Cresol	60 parts
Formaldehyde solution	15 “
Glycerin	10 “
Zinc oxide	10 “

Boric acid, enough to make a stiff paste.

5.

Gutta-percha base plate	60 parts
Rosin	60 “
Chloroform	240 “

6.—Eucapercha Compound; Buckley.

Dental base plate gutta-percha	5 parts
Eucalyptol compound (see page 174)	5 “

Make solution by aid of heat, avoiding the loss of eucalyptol.

7.—Eucalyptol Gutta-percha.

Thymol	1 part
Gutta-percha base plate	99 parts
Eucalyptol	100 “

Melt together in a porcelain capsule by carefully heating on a water-bath.

8.

Powder.

Thymol	5 parts
Dried alum	10 “
Kaolin	25 “

Liquid.

Formaldehyde solution	1 part
Cresol	2 parts
Alcohol	3 “

Mix to a stiff paste before using.

9.

Powder.

Paraform	4 parts
Iodoform	1 part
Thymol	1 “
Zinc oxide	14 parts
Tannic acid	20 “

Liquid

Phenol	5 parts
Oil of clove	5 “
Oil of cinnamon	5 “
Glycerin	5 “

10.

Powder.

Zinc oxide	8 parts
Zinc sulphate, exsiccated	2 “

Liquid

Cresol	3 parts
Formaldehyde solution	1 part
Eugenol	1 “

11.

Powder.

Hydronaphthol	1 part
Zinc oxide	2 parts

Liquid.

Hydronaphthol	2 parts
Alcohol	36 “
Oil of clove	12 “

12.

Powder.

Zinc oxide	20 parts
Paraform	5 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid.

Zinc sulphate	6 parts
Water	20 “
Cresol	1 part

13.—Wakefield.

Powder.

Alum	2 parts
Thymol	4 “
Zinc oxide	240 “

Liquid.

Formaldehyde solution	2 parts
Alcohol	4 “
Creosote	90 “

14.

Powder.

Xeroform	5 parts
Thymol	1 part
Dried alum	3 parts
Zinc oxide	5 “

Liquid.

Eugenol	5 parts
Cresol	5 “

15.—Formagen; Abraham.

Powder.

Fresh slaked lime	10 parts
Zinc oxide	20 “
Quartz	20 “
Kaolin	50 “

Liquid.

Formaldehyde solution	1 part
Oil of clove	2 parts
Creosote	3 “
Alcohol	4 “

Mix to a stiff paste before using.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

16.—Eucaine-Formol-Phenol Paste; Witzel.

Powder.

Eucaine	3 parts
Phenol, liquid	5 “
Paraform	10 “
Zinc oxide	10 “

Liquid.

Eugenol	10 parts
Formaldehyde solution	40 “
Glycerin	50 “

Mix to a stiff paste before using.

17.—Oxpara; Jones.

Powder.

Alum	3 parts
Tannic acid	5 “
Thymol	5 “
Zinc oxide	120 “

Liquid.

Glycerin	5 parts
Formaldehyde solution	200 “
Tricresol	200 “

18.—Dodel.

Paraffin	48 parts
Salol	12 “

Melt the paraffin on a water-bath, remove from the fire and add the salol with constant stirring.

19.

Hard paraffin	48 parts
Aristol	6 “

Prepare as above.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

20.

Thymol	1 part
Bismuth trioxide	34 parts
Hard paraffin (130° F.)	65 "

Prepare as above

21.—Dunning.

Paraform	2 parts
Bismuth subnitrate	8 "
Paraffin	8 "

Prepare as above.

22.—Rosin Solution for Gutta-percha Root Canal Filling; Callahan.

Rosin	1 part
Chloroform	5 parts

23.—Gutta-percha-paraffin Oil Paste for Root Canal Filling.

Pink base plate gutta-percha	10 parts
Paraffin oil (Nujol)	10 "

Heat in a sand-bath until completely dissolved.

24.—Disappearing Root Filling; Ferris.

Isinglass	60 parts
Tannic acid	$1\frac{1}{2}$ "
Tricresol	4 "
Distilled water	90 "

When heated to a temperature of 100° F. in an ordinary gluepot or water-bath, it becomes syrupy and can be readily introduced into the root canals with a piece of sterile catgut. If the canal be large the catgut may be left in the canal. A ball of stiff phosphate of zinc is then pressed into the pulp chamber, forcing the mixture through the canal and fistula.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PULP MUMMIFYING PASTES.

1.—Soederberg.

Alum	1 part
Thymol	1 "
Glycerin	1 "

Zinc oxide, enough to make a paste.

2.

Cresol	10 parts
Thymol	10 "

Zinc oxide, enough to make a stiff paste.

3.

Cocaine hydrochloride	1 part
Thymol	1 "
Formaldehyde solution	1 "
White vaseline	3 parts
Zinc oxide	7 "

4.—Gysi.

Cresol	10 parts
Creolin	20 "
Glycerin	4 "
Trioxy methylene (paraform)	20 "
Zinc oxide	66 "

ASTRINGENT TO BE APPLIED TO THE ANESTHETIZED DENTAL PULP.

Renström.

Alum	40 parts
Glycerin	100 "
Thymol	½ part

SOLUTION FOR RESTORING THE TRANSLUCENCY OF DENTIN.

Renström.

Chloral hydrate	20 parts
Distilled water	5 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Apply on cotton. Place into the cavity of the pulpless tooth for about twenty seconds.

PULP CAPPING MATERIALS.

1.

Aristol, or europhen	1 part
Calcium phosphate	10 parts

Eugenol, enough to make a creamy paste.

2.—Thymolized Calcium Phosphate; Buckley.

Thymol	10 parts
Calcium phosphate, precipitated	438 “

3.

Thymol	1 part
Zinc oxide	2 parts

Melt the thymol in a porcelain capsule and gradually add the zinc oxide. Spread on a glass slab and on cooling it is removed and preserved in a well-stoppered bottle.

4.

Gum benzoin	3 parts
Balsam of tolu	2 “
Eugenol	2 “
Thymol	1 part
Chloroform	8 parts

AGENTS FOR REDUCING HYPERSENSITIVE DENTINE.

1.—Robinson's Remedy.

Phenol crystals	2 parts
Potassium hydrate	2 “

Mix by trituration with a few drops of glycerin in a warmed wedgwood mortar until a crystalline paste is obtained.

2.

Sodium carbonate crystals	1 part
Potassium carbonate crystals	5 parts

Triturate in a mortar until a paste is obtained.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.—Desensitizing Paste; Buckley.

Neothesin	9 parts
Thymol	10 “
Trioxymethylene (paraform)[1]	63 “
Vaseline, enough to make	180 “

A “fibrous vehicle” and an “insoluble pigment” are added which play no part in the therapeutic action of this compound.

4.

Solution of formaldehyde	2 parts
Thymol	2 “
Eugenol	2 “

Zinc oxide, enough to make a stiff paste.

5.

Bencyl alcohol	50 parts
Chloroform	30 “
Alcohol	20 “

6.

Silver nitrate	1 part
Gutta-percha base plate	2 parts
Zinc oxide	10 “

7.

Zinc chloride	2 parts

Absolute alcohol, enough to make a solution.

8.

Orthoform	2 parts

Eugenol, enough to make a paste.

Absolute Alcohol for Dehydrating Dentin.

Well-burned unslaked lime	1 part
Alcohol	5 parts

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[1] Formaldehyde, in any form, employed for the purpose of reducing hypersensation of dentin is a most dangerous agent, as it usually kills the dental pulp.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

1.—Silver Nitrate Reducing Solution; Shansay.

Solution A.

Saturated solution of silver nitrate . . .	1 part
Asbestos felt, a convenient quantity.	

Saturate the asbestos felt with the silver nitrate solution, dry, and keep in a dark bottle.

Solution B.

Saturated solution of sodium hydroxide .	50 parts
Phenol, liquid	50 “
Formaldehyde solution.	25 “

Keep in a well-stoppered bottle.

Dip the prepared silver nitrate asbestos into this solution, and apply to the tooth.

2.—Howe.

Solution A.

Saturated solution of silver nitrate . .	1 part
Strong ammonia water, enough to make a clear solution.	

Add the strong ammonia water little by little. As the ammonia water is added a dark precipitate of silver oxide is thrown down. This is soluble in an excess of ammonia water, therefore, continue adding the latter until the solution becomes clear.

Solution B.

Formaldehyde solution.	1 part
Distilled water	3 parts

These solutions must be kept in separate dark-colored bottles, with glass stoppers, and should be kept away from the light as much as possible They work better if they are freshly prepared, but are still good after a considerable time, if kept as recommended.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.—Rickert.

Silver oxide is precipitated from a silver nitrate solution by KOH or NaOH. This is carefully washed to remove all impurities and kept moist in a small amber-colored bottle. In this condition reduction is so slight that it may be kept for a long time without much change. If a small amount is insoluble in excess of ammonia there has been too much reduction and the silver oxide should be freshly prepared. This is our stock solution made from silver nitrate, because it is free from nitric acid and other impurities. Now when we desire rapid reduction, the silver oxide is added to a drop or two of ammonium hydroxide to the point of saturation. In this state the ammoniacal solution is easily reduced. There is one precaution that must be mentioned here, *i. e.*, that after a few hours, fulminate of silver may be formed from the ammoniacal solution, which is very explosive.

REMOVAL OF BROKEN INSTRUMENTS FROM ROOT CANALS.

Solution A.

Nitric acid	5 parts
Distilled water	5 “

Solution B.

Potassium iodide	2 parts
Distilled water	3 “

After complete solution add

Iodine crystals	2 parts

Keep in a glass-stoppered bottle and preserve in a tightly closed box in the laboratory.

An attempt always should be made first to loosen the piece by some mechanical device. If this method fails, the root canal is sufficiently enlarged and a drop of 50 per cent nitric acid (solution A) is worked into the canal with a platinized gold broach. It may be followed by a second

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

and third drop at two-minute intervals. To neutralize the acid, sodium dioxide carried on a broach wound with a few fibers of asbestos and dipped into alcohol is worked in the canal. The canal is now forcibly washed with water, carefully dried and with an eye dropper a drop of concentrated iodine-potassium iodide solution (solution B) is transferred to the canal and worked into close contast with the piece of steel with the platinized gold broach. A few fibers of asbestos are saturated with the same solution, packed into the canal and the cavity is carefully sealed with temporary cement. The application should remain undisturbed for at least twenty-four hours. If the piece of broach is not completely destroyed the treatment may be repeated.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER VIII.

AN INDEX TO ORAL DISEASES—THEIR ETIOLOGY, DIAGNOSIS AND TREATMENT. IMMEDIATE TREATMENT OF ACUTE POISONING. SALIVA—AND URINE ANALYSIS. DIAGNOSTIC HINTS.

Abrasion.—The mechanical wearing away of tooth substance, resulting from occlusal attrition or other mechanical causes (clay-pipe stem, glass blowing, sand blasting, etc.); usually not painful, unless the pulp is irritated. Therapeutical applications are of no avail. Filling or capping of the teeth give best results.

Abscess, Acute Alveolar.—*Causes.*—Gangrene of the dental pulp with subsequent infection of the pericementum.

Symptoms.—Swelling, severe pain, fever. The pus burrows along the line of least resistance and after the bone and gum tissues are penetrated, a fistula results. In the lower jaw, the pus may sink into deeper structures and perforation at the chin (chin fistula), of the cheek, along the lower border of the jaw, or about the neck may result. Abscesses about the third lower molars are prone to produce severe complications.

Treatment.—In the early stages, drainage through the pulp canal may be possible. If fluctuation is present, a deep incision is essential or the abscess may be opened with a small tubular knife. If the tooth has to be removed, it should be done at once, although, in protracted cases, swelling may increase even after the tooth has been extracted. Hot poultices in the form of cut figs, steeped in boiling water, helps to bring the abscess to a focus. To establish free drainage is important. The fever is reduced with antipyretics and the engorgement of the system is relieved by saline laxatives. Severe pain is best combated with morphine. The septic root canals require proper treatment as outlined under Pulpitis (Gangrene).

℞—Magnesii sulphatis		℥j
Acidi sulphur. dil.		fl.ʒss
Syr. limonis.		fl.℥j
Aquæ	q.s. ad	fl.℥iv—ℳ

Sig.—A tablespoonful in a glassful of water every three hours.

℞—Pil. morph. sulphatis	gr. 1/8 to 1/6

No. III.

Sig.—One pill every two hours until pain is relieved.

℞—Phenacetini	ʒss

M. f. plv. No. vi.

Sig.—One powder every two hours.

Actinomycosis.—Known in cattle as "wooden tongue" or "lumpy jaw." A chronic, infectious disease of cattle, sometimes transmitted to men, caused by actinomyces bovis, the ray fungus, a parasitic bacterium. It may involve the jaws (especially the lower), the tongue, the neck, etc. The fungus usually enters through objects which have come in contact with diseased cattle or directly with vegetable particles upon which it grows. Carious teeth or wounds about the mouth are favorable ports of entry.

Symptoms.—Hard, board-like, slow swelling of the affected parts, occasionally accompanied by severe pain in the involved region, periosteal inflammation and formation of abscesses.

Diagnosis.—Only positive by means of the microscope.

Treatment.—Surgical, free incision of foci. The internal administration of potassium iodide in large quantities (10 to 15 grains in milk, three times daily) is recommended. Good results are reported from the internal administration of copper sulphate, 1/4 to 1/2 grain, three times daily.

Arsenical Necrosis.—Local toxic effects of arsenic in the mouth are most frequently met with as the result of faulty application of the chemical for dental purposes. Leakage of the dressing seal is responsible in most cases, and contact of the mucous membrane with instruments accidentally carrying small particles of the paste, or the unnoticed squeezing out of arsenic resulting from pressure applied on placing the retaining stopping, are possible factors. The fact that arsenic trioxide is odorless and tasteless increases this danger, which is usually recognized only after the mischief is done. A number of cases of severe forms of toxic periostitis, followed by necrosis of the alveolar process, and consequent loss of one or more teeth, are on record. Arsenical intoxication of the gum tissue presents in its early stages all the phenomena of true inflammation. Later the surfaces become denuded and assume a raw ham color; the veins are distended, the border of the infected area is raised and shows loss of substance in the depressed center, *i. e.*, the typical picture of an ulcer. Usually there is a pronounced metallic taste present in the mouth. Arsenic penetrates very deeply, destroying the soft and hard tissues, which finally results in necrosis and gangrene. In the early stages the affection is not painful, but, as soon as the deeper structures are reached, severe pain is manifested.

Treatment.—The treatment depends on the severity of the poisoning. Simple intoxication requires the immediate removal of the cause and mild antiseptic mouth washes. If necrosis has set in, the affected parts must be thoroughly curetted with a large spoon excavator; if the bone has sequestrated, it must be removed. Local anesthesia is usually serviceable for such work. The denuded surface is dusted with a mixture of orthoform and corn starch, 1 to 4. If sequestration of the alveolar bone continues, the application of aromatic sulphuric or diluted sulphuric acid will be of assistance in detaching the dead bone. Rigid antisepsis is of prime importance. A bland antiseptic used warm and at frequent intervals is indicated as a mouth wash. The local application of dialyzed iron or solution of iron chloride as arsenical antidotes is indicated only if arsenic is present in substance on the tissues; after it is absorbed, these solutions are useless.

℞—Orthoform	ʒj
Lanolin	℥ss

M. f. ungt.

Sig.—Spread on painful area and cover with a strip of gauze.

℞—Orthoform	ʒj
Amyl.	℥ss

M. f. pulv.

Sig.—Dusting powder.

Burns.—Burns are caused by the action of intense heat upon the tissue; in the mouth they are rarely worse than the first degree. They require little more than palliative treatment; *i. e.*, ice and saturated solution of sodium bicarbonate. Accidental cauterization of the oral tissues with strong acids or alkalis may occur; the treatment should correspond to the chemical nature of the caustic. Severe pain is relieved by dusting the corroded surfaces with mixtures of orthoform and starch, equal parts.

Caustics	Require
Silver nitrate	Concentrated solution of sodium chloride.
Ammonia water	Lemon juice or diluted vinegar, white of eggs, demulcent drinks.
Caustic potash (lye)	Same treatment as for ammonia.
Mineral acids	Gargle with soapsuds, give chalk, raw egg and lime water.
Phenol and trichloracetic acid	Fifty per cent alcohol as quickly as possible, followed by rinsing the mouth with cold water and the application of a mild ointment.
Tincture of iodine	Sweetened water.
Formaldehyde solution	Ammonia water, well diluted.
Pyrozone	Alcohol, followed by water.

Cyanosis.—Blue discoloration of the skin resulting from insufficient oxygenation of the blood.

Treatment,—Remove the cause; fresh air and horizontal position of patient and rest.

Cysts.—Slowly growing benign tumors containing serous, mucous, hemorrhagic or other fluids. They may be divided into follicular cysts, dermoid cysts and radicular cysts. Follicular cysts, resulting from abnormal enlargement of preëxisting cavities, frequently contain remnants of the enamel organ in the form of imperfectly developed teeth (odontomes) and are then spoken of as dentigerous cysts. Dermoid cysts are formed from remnants of epithelial cells; they are only very occasionally found in the oral cavity. A radicular cyst is always the sequence of a preëxisting epithelial granuloma, *i. e.*, a chronic proliferating pericementitis about the apical end of a tooth. The disturbance may manifest itself in the form of a fungoid new-growth, *i. e.*, a simple or an epithelial granuloma. The epithelial granuloma is the most frequent type. Scattered in its wall are found the rests of the paradental epithelial débris of Malassez, *i. e.*, epithelial remnants of the embryonic dental groove or ridge. As a sequence of chronic irritation, principally from toxins, the epithelial rests begin to sprout and to grow until a complete sac is formed. At this moment the radicular cyst is born, as it were. Retention cysts are formed through the enclosure of a gland duct, either by some remaining epithelial cells or through an obstruction of the duct from other sources. An important cyst of the mouth is ranula, a retention cyst of the sublingual glands.

Treatment.—Dentigerous cysts are referred to the surgeon; a ranula may be destroyed by caustics or it is surgically removed. A stout silk thread is drawn through the cyst and tied over its outer wall (seton). In from ten to fifteen days the inner cyst wall may unite. Extirpation of a part of the cyst wall or of the entire gland may be necessary. Truman W. Brophy employs a metal seton made of a "small silver tube and perforating it with holes; then, bending it so as to form a ring about one-half inch in diameter. This is an open ring, one end of which is carried into the cyst and out through the mucous membrane and telescoped into the other end, thus uniting the ends of the two and completing the ring. The perforated ring thus introduced will admit the saliva within the cyst and allow it to escape through the tube into the mouth. The ring must be rotated daily, else the tissues may fill the openings in it, thus defeating the object of this insertion. The tissues around the ring will become smooth and a few weeks only will suffice to establish permanent openings, after which the ring may be removed and the saliva will escape through the opening so perfectly formed around the silver tube."

The operation for a radicular cyst depends primarily upon the size of the cyst. Small cysts of about the size of a cherry are treated exactly as granulomas, while larger ones require a somewhat modified procedure, *i. e.*, they are removed by the modified Partsch operation. The basic principle of this operation involves the transformation of the existing cystic cavity into an accessory cavity of the mouth by the complete extirpation of its anterior wall. The cyst is lined with secreting epithelium, which genetically is identical with that of the oral cavity, hence the absolutely sure return of the cyst when the cavity is allowed to close.

In operating upon a large cyst, the preliminary procedures are the same as those employed for the operation on granulomas. After lifting up the overlying soft structures the entire anterior bony wall of the cyst must be cut away. After the cyst bag is opened and its contents washed out, and the roots of the teeth projecting into it are cut off, the cavity is lightly curetted, the flap folded into it, and the entire cavity tightly packed with a strip of 5 per cent iodoform gauze. Extreme care must be observed in curetting the walls of a large cyst. The resorption of bone in the upper jaw may be so complete that the curette will readily pass through the soft tissues into the roof of the mouth, antrum, or nose, and in the lower jaw the mandibular nerve, artery, and vein may lie exposed at the bottom of the cavity. Large cysts of the mandible predispose this bone to pathologic fractures. The packing is removed after twenty-four hours, when the cavity is again lightly plugged, and the gauze tampon is changed about every fourth day until the cavity is completely lined with epithelium from the ingrowing mucous membrane.

Dental Caries.—This is a chemico-parasitic process, consisting of two definite stages—decalcification of the tooth substance and the destruction of the remaining organic matrix. The second stage is not to be clearly observed in the decalcification of the enamel (Miller). As predisposing factors are to be mentioned: Poorly calcified teeth, irregularities of form and position, unhygienic surroundings, constitutional disturbances, the condition of foodstuffs, etc.

Treatment.—As prophylactic measures, suitable food materials rich in lime and phosphorus, vigorous exercise of the jaws, and proper hygiene of the mouth, are indicated. In the early stages of caries, the application of silver nitrate under suitable conditions will inhibit the progress of the disease. The treatment of the carious defects consists in the thorough removal of all decayed material, and in filling and restoring the normal outline of the tooth. (For mouth and tooth preparations see Chapter VI.)

Dental Hemorrhage.—Results from tearing the blood-vessels of the periosteum during the extraction of teeth. Occasionally profuse hemorrhage occurs from tearing large arteries in extracting lower molars (inferior dental artery). About a dozen cases are on record where the artery bodily passed through the roots of these molars. Organic disturbances, *i. e.*, hemophilia, chlorosis, anemia, leukemia, etc., are often responsible for persistent dental hemorrhage. Vicarious hemorrhage of the gum tissue may occur during menstruation.

Treatment.—Normal dental hemorrhage resulting from the extraction of teeth, etc., requires little attention; in severe cases plugging and splinting of the sockets is usually always successful. Introduce softened modeling compound into the mouth, let the patient close the jaws, press about the teeth, remove, chill and trim. Wash away the blood clot, and tightly pack into each single alveolus a narrow strip of iodoform gauze, having the tip of the gauze moistened with thromboplastin solution. Have the plug slightly extending above the border of the alveolus. Replace the prepared splint and apply a Barton bandage (figure-of-8). The plug and the splint may remain several days. Internal administration of drugs for this purpose are of no avail; to reduce blood-pressure give 5 grains of phenacetin. Let patient assume a sitting posture; keep him from all excitement and order liquid diet. No alcoholics should be allowed. If hemorrhage occurs from torn gum tissue, apply gauze strips dipped in the thromboplastin solution. Severe interpapillary hemorrhage is checked by applying a 25 per cent solution of chromic acid. Occasionally parenchymatous hemorrhage occurs in patients wearing full dentures. It is usually due to ill-fitting plates, uncleanliness, etc. Cleanse the plate thoroughly, cover with thin gauze strips dipped in thromboplastin solution and reinsert the plate. Remedy the defects of the denture. Hemophiliacs are preferably removed to a hospital and placed under the care of a physician.

Dental Pharyngitis (*Dental Angina*).—Catarrhal inflammation of the upper pharynx from dental causes; usually resulting from difficult eruption of a third lower molar or as a sequence of stomatitis and other mouth infections.

Symptoms.—Difficult and painful deglutition, a typical inflamed ring about the pillars of the fauces and infection of the tonsils.

Treatment.—Saline purge, prohibition of tobacco, alcohol and highly spiced food. Gargling with antiseptic and astringent solutions, and, in severe cases, silver nitrate or iodine application.

℞—Tinct. ferri chloridi		fl.ʒiij
Glycerini		fl.℥j
Aquæ	q.s. ad	fl.℥iij—M.

Sig.—A tablespoonful in half a glass of warm water as a gargle.

℞—Iodini	gr. v
Pot. iodid.	ʒss
Glycerini	fl.℥ss—M

Sig.—Apply on a swab.

Dentition.—This is a physiological process which, normally, is not accompanied by any disturbances. The so-called diseases of dentition, *i. e.*, diarrhea, dysentery, fevers, etc., result, in the majority of instances, from improper feeding during the period of most active development of the child. If the teeth erupt too early, extraction is not indicated unless some faults in their development make it necessary. The removal of such teeth is usually accompanied by severe hemorrhage. The eruption of the teeth may, by reflex irritation from pressure upon the overlying gum tissue, cause discomfort to the child. It is readily relieved by proper scarification. A deep cut is made over the advancing tooth, *i. e.*, crucial incisions over the molars, and singly over the cutting edges of the anterior teeth. General disturbances are to be treated according to symptoms.

The eruption of the third molars frequently causes severe disturbances on account of lack of space and malposition. These disturbances are traumatic in their nature, and should be treated accordingly. If the tooth is to be removed, general anesthesia is usually indicated; the accompanying trismus and infiltration of the tissues prevent the successful injection of a local anesthetic. Lecluse's elevator is of excellent service if the tooth cannot be reached with the ordinary or a Physick's forceps. The gum tissue overlying the tooth is to be divided before the extraction is made. If the socket is infected and painful, packing with iodoform gauze dipped in orthoform and strict antisepsis are important. Dry, hot applications applied externally are of service. The swelling about the angle of the jaw and the lymph glands is benefited by the application of an iodine solution or ointment, by passive massage, and by dry heat. Sore throat (see Dental Pharyngitis) very frequently accompanies the eruption of this tooth. In the early stages, small chips of ice held in the mouth, together with the removal of the overlying gum tissue, and antiseptic washes will often result in a speedy recovery.

℞—Iodipini, 10 per cent. fl.℥j

Sig.—Paint upon the inflamed surface and cover with a strip of gauze.

Dislocation of the Mandible.—It may be unilateral or bilateral; more prone in women than in men. One or both condyles have slipped out of the glenoid cavity and rest upon the interarticular fibrocartilage directly over the articular eminences. The jaw is usually rigid, the mouth wide open; chewing and speaking is much impaired.

Treatment.—Place patient in a low chair, the operator wraps his thumbs with cotton or with napkins to protect them against injury. He stands in front of the patient, having the head fixed by an assistant or on the head rest of the chair and then places the thumbs firmly upon the jaw in the region of the lower molars while the other fingers rest on the body of the jaw near the symphysis. Pressure is now made downward with the thumbs and forward and upward with the fingers, and when the condyles have passed the articulating eminence they will snap back into the glenoid fossæ. A metal rod (excavator) covered with cotton and placed crosswise over the teeth in the premolar region acts as a fulcrum when backward and upward pressure is brought upon the symphysis and it may be used for this purpose. The patient should be instructed to be careful in not opening the mouth too far. A chin bandage may be worn for a few days.

Dry Mouth (*Xerostomia*).—Pathological dryness of the mucous membrane of the mouth resulting from impaired secretions of saliva.

Causes.—Severe psychical and physical disturbances, atrophy of the salivary glands, nervous diseases, diseases of the digestive tract and other unknown factors. The diseased salivary glands (mumps) may secrete a much lessened amount of saliva at times.

Symptoms.—Painful deglutition and speech. The mucosa is dry, shiny, and stretched; the tongue is bright red, cracked and dry. No inflammation. The disease may last for years and occurs principally in elderly women.

Treatment.—Pilocarpine hydrochloride internally; if resulting from nervous disease, electricity is indicated. While recovery is very problematical, the patient may be made comfortable by continuous use of the above drug.

℞—Pilocarpin. hydrochlorid.	gr. v
Aquæ distillatæ	fl.℥ss—♏

Sig.—Five drops three times daily in water. Slowly increase the dose by 1 drop until from 8 to 10 drops per dose are taken.

Dyspnea.—Labored breathing; suspended animation from a deficiency of oxygen in the blood. May also result from inhaling an anesthetic or poisonous gases; *i. e.*, coal gas, water gas, etc.

Treatment.—Fresh air, horizontal position of patient, dashing of cold water in the face and artificial respiration.

Emphysema of the Cheek.—The inflation of the interstices of the connective tissues with air. It may result from air penetrating into the tissues after tooth extraction or from careless injection of solution of hydrogen peroxide into a closed cavity, setting free nascent oxygen.

No treatment necessary, as swelling will subside spontaneously. A tight bandage over the affected region is often of some benefit.

Empyema of the Maxillary Sinus (*Antrum of Highmore*).—An accumulation of fluid in the maxillary sinus; either acute or chronic. It may be caused by infectious diseases (influenza), diseases of the teeth, traumatism, etc. Tumors, polypi and other foreign bodies are often responsible.

Symptoms.—More or less dull pain in the affected side of the face; foul-smelling discharge from the nostril, especially when the head is bent forward and turned to the sound side and in blowing the nose. The disease may be unilateral or bilateral.

Diagnosis.—Discharge from the nose and the general symptoms are helpful in making a diagnosis. The dull shadow picture of the diseased sinus as revealed by the rays of the electric mouth lamp is helpful but not reliable. A trial puncture and washing of the sinus with a saline solution is the most positive means of diagnosis.

Treatment.—If a diseased tooth is the causative factor, the tooth is to be removed and the sinus opened through its socket, according to Cowper, provided the opening affords ready access to the sinus; or an opening is made between the apices of the roots of the first molar and the second premolar, according to Drake. The opening of the sinus through the canine fossa, according to Desault, offers the best results, as it allows a clear inspection of the entire cavity. The gum tissue between the canine and the first molar is locally anesthetized, a straight cut is made reaching from the canine eminence to the second premolar, and the tissues, including the periosteum, are lifted up. With a fine spear drill the facial wall is perforated and with suitable fissure burs sufficiently enlarged to allow the little finger to enter. Foreign bodies or granulations are removed with the curette. The sinus is washed with at least a quart of warm saline or Thiersch's solution and tightly packed for twenty-four hours with iodoform gauze. The further treatment consists in irrigating the sinus with mild antiseptic solutions. Solid plugs made of gutta-percha, vulcanized rubber, or metal should never be used. In extreme cases, a large part of the facial wall is removed, and a "window," according to Denker, is made leading into the middle meatus of the nose; the whole sinus is thoroughly curetted and cauterized. Chronic cases may require treatment for some time.

℞—Pot. permanganat.	ʒss
Sodii chloridi	℥ss
Aquæ	fl.℥L—m

Sig.—Use as a douche.

℞—Acidi salicylici	ʒj
Acidi borici	ʒiv
Aquæ	fl.℥xxxij—m

Sig.—Thiersch's solution.

Exostosis.—See *Hyperplasia of Cementum.*

Fracture of the Alveolus.—Resulting from difficult or clumsy extraction or other traumatic causes.

Treatment.—Remove loose pieces and smooth sharp edges of the bone with suitable large fissure burs. If the teeth are loose, they are tied with silk ligatures. If the alveolar process is broken, replace it, if possible, and if the teeth are present, ligate them to sound neighbors. Paint with Talbot's iodine solution and advise ice to be held in the mouth to reduce inflammation. Astringent mouth washes are indicated.

℞—Acidi benzoic		ʒj
Tinct. krameriæ		fl.℥ss
Aquæ hamamelidis	q.s. ad	fl.℥iv—ℳ

Sig.—Tablespoonful in a glassful of warm salt water as a gargle.

Fractures of the Jaws.—*Upper Jaw.*—It is comparatively rare; it is frequently accompanied by crushing of the maxillary sinus (antrum of Highmore) and fracture of the other bones of the face and skull.

Treatment.—Replace fragments by manipulating through the mouth and nose. In vertical fractures, an interdental splint is indicated. (Gunning's or Kingley's splint with the necessary modification.) Feed the patient on a liquid diet. Union takes place in from three to five weeks.

Lower Jaw.—The fractures are recognized by mobility, crepitus, and dropping of the mouth on the side of the face.

Treatment.—If teeth are present simply lash the lower jaw firmly to the upper by wire ligatures (No. 28 German silver or brass wire) or by means of Angle's or Lukens' fracture bands applied on both sides of the fracture. Look after correct articulation. In complicated cases, an interdental splint with or without external steel hooks or a Gunning splint is indicated. A suitable splint may be quickly constructed over the articulated models from a good, hard modeling compound; it can be kept in the mouth for a month without deterioration. A chin boot made of metal, vulcanite or gutta-percha is occasionally helpful. In edentulous jaws an interdental splint is essential. A Barton or Black bandage is of advantage. Union will take place in from three to five weeks. Antiseptic mouth washes are indicated. Feed the patient on a liquid diet with a hooked glass tube (short bent saliva ejector) around the molars.

℞—Resorcinol	ʒj
Zinci chloridi	gr. x
Mentholis	gr. xx
Thymolis	gr. xv
Glycerini	fl.℥j
Alcoholis	fl.℥ij
Aquæ hydrogenii dioxidi	q.s. ad fl.℥viij—ɱ

Sig.—Teaspoonful in half a tumblerful of warm water as a mouth wash.

Fracture of the Teeth.—If the crown is fractured, replace it by an artificial substitute; if the root is fractured, an attempt may be made, in favorable cases, to save it by banding. Callous union may occur if the pulp recovers.

Gingivitis (**Acute or Chronic**).—An inflammation of the gum tissue.

Symptoms.—More or less severe inflammation of the gums brought about by local irritation; ill-fitting partial dentures are frequently the cause. The gums are turgid, loosened from the teeth, and upon slight irritation they bleed profusely.

Treatment.—Thorough removal of all deposits from the teeth and especially from beneath the free edge of the gum margin; and thorough polishing of the tooth surfaces. The inflamed edge of the gum is touched with a 10 per cent solution of trichloracetic acid or with powdered copper sulphate made into a paste with water.

℞—Cupri sulphatis	ʒj
Acidi lactici	fl.℥ss—ɱ

Sig.—Apply with a platinum loop about the free edges of the gums.

℞—Acidi borici	ʒiij
Zinci chloridi	gr. x
Aquæ hydrogenii dioxidi . . .	fl.℥ij
Aquæ menth. piper . .	q.s. ad fl.℥viij—M

Sig.—A teaspoonful in half a glassful of warm water as a mouth wash.

ACUTE ULCEROUS GINGIVITIS (Gilmer).—A comparatively rare disease; its onset is sudden. It is confined to localized areas, seldom involving the entire gum tissue. "The lingual margins and festoons of the gums do not participate at first in the inflammatory process, but later the festoons are destroyed and deep pockets are formed in the interproximal spaces. The parts attacked present the appearance of having been gnawed away until most of the gum tissue overlying the alveolar process immediately adjoining the teeth has been destroyed. The breath of the patient is fetid, the saliva ropy, and in excess of the normal" (Gilmer). The disease may last for weeks or months.

Treatment.—Irritating foodstuffs are to be avoided. Bland and slimy drinks, such as rice water, oatmeal infusion, etc., are advised, and mild antiseptic mouth washes, but no astringents, are indicated.

Hyperplasia of Cementum.—A circumscribed increase of the volume of the cementum of a tooth; diffuse growth is sometimes referred to as hypertrophy of the cementum.

Causes.—Irritation from projecting root fillings, crown fillings, ill-fitting bands, or other chronic irritation of the pericementum. Pyorrhea alveolaris, syphilis, metal poisoning (mercury) or the loss of the opposing tooth are claimed to be causative factors.

Symptoms.—Usually not present. Gnawing and neuralgic pains are met with.

Diagnosis.—Difficult. The roentgenographic picture of the suspected tooth may be of value.

Treatment.—In suitable cases amputation of the root is advisable, otherwise extraction, which, however, is often very difficult and usually accompanied with considerable bruising and damaging of the alveolar bone.

Hypertrophy of the Gingivæ.—A pathological overgrowth of gum tissue resulting from chronic irritation brought about by ill-fitting crowns, calcareous deposits, and neglected mouth hygiene. The hypertrophic growth may be of a fibromatous nature.

Treatment.—Simpler cases yield readily to local treatment; remove the cause and thoroughly clean the mouth and the teeth and apply caustics, *i. e.*, properly diluted solutions of chromic or trichloracetic acids. Larger areas of hypertrophied tissues are removed with the knife. In severe cases, major surgical interference is necessary.

Leucoplakia (*Leucoplakia Oris, Psoriasis Linguæ, Ichthyosis Buccalis, Smoker's Patch*).—*Etiology.*—Not settled; constant chewing or smoking of tobacco highly seasoned food, rough edges of teeth, predisposition of the tongue and the mucous lining of the mouth, or as a result of a former attack of syphilis. Rarely seen before thirty years of age; scarce in women.

Symptoms.—Circumscribed or diffused white or bluish-white patches; smooth, cornified or roughened. The epithelium is much thickened. It is usually not painful; in some cases increased flow of saliva, in others, dry mouth.

Diagnosis.—Differentiation from syphilitic plaques: Its bluish-white color, extreme chronicity and its history. If as a result of syphilis, the latter is to be regarded as the primary disease.

Treatment.—In general, leucoplakia may be harmless; however, in advanced cases, it is often the starting point of cancer. Bring the mouth to a hygienic condition; alkaline mouth washes are indicated. Paint the affected parts with balsam of Peru. Hydrogen peroxide solution for cleansing the plaques is useful. Papain solution for the digestion of the plaques is recommended. Prolonged cauterizing is harmful. In general, medicinal treatment is of little benefit. Surgical removal of the plaques by means of the curette or the Paquelin cautery is indicated, if the plaques spread.

℞—Papaini		gr. x
Glycerini		fl.ʒj
Aquæ	q.s. ad	fl.ʒij—♏

Sig.—Paint upon the affected surface.

Lockjaw.—(Trismus, either tonic or clonic spasms of the muscles of mastication).—Tonic spasms may result from difficult eruption of the lower third molars, faulty extraction, improper injections of local anesthetics, abscesses, or periosteal inflammations and severe infections (actinomycosis).

Treatment.—According to the causes. Inflammatory processes in the early stages may be abated by ice, or sometimes by dry heat applied externally (hot water bag). Abscesses should be at once opened and hot fomentations applied externally. Clonic spasms do not require treatment. In true ankylosis, separation of the ankylosed joint by an operation is the only relief.

Luxation of the Mandible.—See Dislocation.

Luxation of Teeth (Resulting from Traumatic Causes).—*Treatment.*—In complete luxation replace the teeth and tie with silk ligature to the neighbors. Apply Talbot's glycerol of iodine to allay periosteal disturbances. Test for pulp reaction with heat, the mouth lamp, and the electric current. If the tooth is completely detached from its socket, replantation is advisable. Pack the cleansed alveolus tightly with iodoform gauze. Remove the pulp, fill the canal aseptically, cut off about $\frac{1}{8}$ inch of the apex and sterilize the tooth in mercuric chloride solution 1 : 1000. If the peridental membrane of the tooth is intact, keep the tooth in physiological salt solution, warmed to body temperature, until ready for replantation. Replace and tie with silk ligature or hold the tooth in position with a metal splint. Antisepsis of the mouth is essential.

Mouth-wash Eczema.—A peculiar eczematous eruption about the external mouth caused by the constant irritation from the use of mouth washes containing large quantities of essential oils, menthol, salol, etc., in alcoholic solutions.

Symptoms.—Scaly eruptions about the lips and chin but more especially at the corners of the mouth. Those suffering from seborrhea and eczema show predisposition.

Treatment.—Prohibition of the mouth wash, substituting warm salt water as a test solution. Externally apply zinc ointment or cold cream.

Necrosis of the Alveolar Process.—It may result from faulty arsenic application, phosphorus poisoning, gangrene of the dental pulp, abscesses, etc.

Symptoms.—It usually starts with a simple periostitis; later the formation of abscesses and fistulas occurs. The periosteum is destroyed and the bone feels rough to the touch. Sequestration of the dead bone takes place in due time.

Treatment.—If the necrosis is the result of traumatism, the removal of the loose bone spicula and antiseptic treatment of the wound will usually bring about a speedy recovery. If a large part of the bone is involved, no interference should be made until sequestration takes place. Free evacuation of pus is essential. If a part of the jaw is removed prosthetic appliances are usually necessary to preserve the contour of the face. Strong deodorizing and antiseptic solutions are essential.

℞—Pot. permanganat. . . . . . . ʒij

Sig.—A few crystals in a glassful of warm salt water as a mouth wash.

℞—Zinci chloridi . . . . . . gr. v
Aquæ hydrogenii dioxidi }
Aquæ menth. pip. . } āā q.s. ad fl.℥iv—ℳ

Sig.—A teaspoonful in half a glassful of warm water as a mouth wash.

Neuralgia (*Trifacial*; *Tic Douloureux*; *Fothergill's Disease*; *Prosopalgia*.—A neuropathic disturbance of nerve fibers without having any direct connection with any organic disease. True trifacial neuralgia manifests itself by a sudden paroxysmal pain of a sharp, darting, stabbing character, which is most common along the course of the supra- and the infraorbital branches of the left side of the face with increased lacrimation, gray eyebrows and convulsive twitches and tenderness at the infra- and supraorbital foramina (points douloureux), as well as along the course of the nerve distribution. It is most often restricted to women of middle age in which neuropathic disturbances or a general disease, principally anemia or hyperesthesia of pregnancy, play predominant roles. Neuralgia should be differentiated from neuritis, *i. e.*, an inflammation of a nerve trunk, primarily characterized by continuous pain, impaired sensation, motor paralysis and atrophy. Central trifacial neuralgia, either from involvement of the ganglion itself or its internal roots, or as a result of pressure from a cerebral tumor, *i. e.*, a neuroma, often leads to a faulty diagnosis of toothache. Many patients suffer the loss of one tooth after another in the vain search for the real cause. After the sacrifice of the teeth the dentist or physician may wake up to the fact that the painful disorder is of a central origin, and that a grave mistake has been made.

Neuralgiform types of pain in and about the teeth of an obscure character are occasionally met with. The true cause of the pain may be located anywhere between the origin of the nerve in the brain and its end-organs, *i. e.*, in our case, in the teeth or within their immediate surroundings; however, the sensation of pain is only manifested at the periphery. If a carefully conducted diagnosis by exclusion has eliminated every one of the above discussed factors, one should be mindful of the possible presence of solid new growths within the body of the pulp, which are referred to as adventitious dentin if attached to the wall of the root canal or as pulp stones or nodules, denticles, internal odontomes, dentinoids, etc., if suspended within its body. The formation of pulp nodules is most likely always due to some type of mild, continuous external irritation which excites the dentin-forming cells of a healthy, and usually, mature pulp to renewed activity. This irritation, however, must never become severe enough to produce acute inflammation. These pulp nodules usually represent pearl-like, shiny beads; they are found singly or multiple and occasionally a few may coalesce into an irregular multiple mass. The pulp chamber as well as the root canals serve as their abodes. Regarding their location in the various types of teeth, it has been observed that the incisors and canines are relatively seldom invaded, while the pulps of premolars, but primarily the molars in mature age, are principally selected as seats of their formation. By their mere presence and close contact with nerve filaments within the pulp these nodules may cause chronic pressure and, as a consequence, more or less severe pain which steadily increases with their growth. Pulp nodules have been observed in root canals which completely occluded their lumen and thereby caused atrophy of the severed pulp stump.

Treatment.—If possible, remove the cause. Careful examination of the teeth for hidden cavities should be made. In obscure cases, the roentgen ray may be of service. If not of dental origin, it should be referred to the physician.

℞—Codeinæ phosphatis		gr. j
Acidi acetyl-salicyl. Phenacetin.	āā	gr. xxv
M. f. cap. No. vi		

Sig.—One capsule every two hours.

℞—Ungt. veratrinæ	℥ss

Sig.—Rub a small quantity over the painful surface, cover thickly with raw cotton and apply the hot-water bag.

℞—Chloroformi. Alcoholis	āā	fl.ʒj
Tinct. aconiti.		fl.ʒij
Olei menth. pip.		fl.ʒiij—♏

Sig.—Externally. Apply on cotton upon the painful surface.

Ostitis and Osteomyelitis.—Inflammation of the jaw bone. It may be idiopathic; it may result from traumatism; it may be a concomitant expression of a general disease or an intoxication. Diseased teeth, fracture of the jaw, syphilis, scurvy, mercury and phosphorus poisoning, and a peculiar infection of the periosteum of the jaw bones and the teeth in workers of mother-of-pearl are causative factors.

Symptoms.—Very painful swelling of the periosteum; the lymph glands are affected and the teeth are loosened.

Treatment.—Poultices are frequently necessary to soften the swelling; if pus is present, an incision is made and the periosteal surfaces are curetted. The wound is washed with antiseptics and cauterized with 8 per cent solution of zinc chloride and packed with gauze. Antiseptic mouth washes are important.

℞—Zinci chloridi	gr. xxxv
Aquæ destil.	fl.℥j—♏

Sig.—To be used as a swab.

Pericementitis (*Inflammation of the Pericementum*).—Clinically, three stages may be observed: Acute, purulent, and chronic pericementitis. Causative factors are: Trauma, too high fillings, rapid separation, root canal fillings protruding at the foramen, traumatic occlusion, foreign bodies between the teeth, calcareous deposits, metal poisoning (arsenic, phosphorus, mercury, etc.), bacterial infection starting from the apex or the gingival border, etc. As secondary factors may be counted: Sequences of general disturbances (gout, rheumatism, syphilis, diabetes, influenza, etc.).

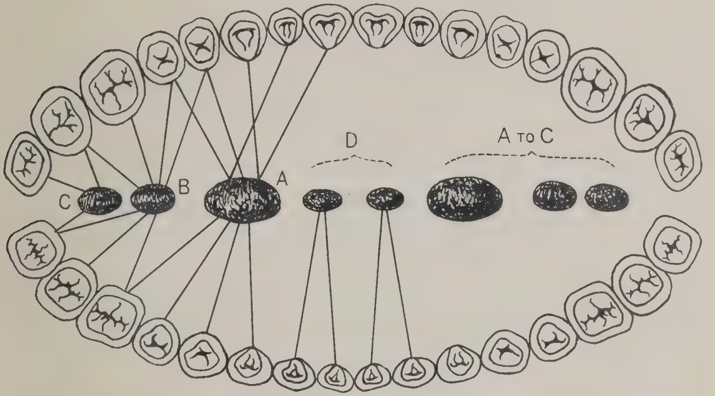
Symptoms.—The tooth feels elongated on account of the swelling of the pericementum. The gum tissue is inflamed and the swelling may become edematous, involving the whole side of the face. The pain is very severe; it slightly subsides with the formation of the edema.

Many practitioners have no clear conception of the difference between pericementitis and pulpitis, inasmuch as each produces a distinct odontalgia or toothache which only close observation will distinguish from the other. And yet the two conditions have little in common except the pain, and that is not of the same character. It may be well to compare their pronounced symptoms as an aid in diagnosis.

DIFFERENTIAL DIAGNOSIS OF INFLAMMATORY DIAGNOSIS OF:

THE PERIDENTAL MEMBRANE.	THE DENTAL PULP.
The pain is localized, dull, steady, boring or throbbing in character; it is not paroxysmal, nor increased by a recumbent position. Pain remains more or less constant without much reference to external conditions.	The pain is of a sharp, lancinating character; in the earlier stages it is distinctly paroxysmal. On assuming a recumbent position, or with excitement or fatigue, the pain usually increases.
There is little reaction to temperature changes; cold may give relief, while heat does not materially affect it.	The tooth is exceedingly sensitive to thermal changes; in its inceptive state cold; later on heat intensifies the pain.
Pressure at first usually relieves the pain, later it is intensified. In the later stages swelling is common.	There is no swelling of the soft tissues about the tooth, and no tenderness to pressure.
The tooth is raised in its socket and strikes before any of the others occlude.	The tooth is not elongated nor does it strike first in occlusion.
The diseased tooth is readily located; the pain is steady in degree and in its position. No reflex symptoms are observed.	At times it is quite difficult to determine exactly which tooth is affected as the pain induces reflex symptoms in other teeth and tissues.
Percussion induces pain.	Percussion is negative.
The tooth is very sore to the touch; occlusion in mastication or ordinary shutting of the teeth produces pain irrespective of thermal changes.	It is possible to bite upon the tooth and to use it in mastication without any special sensation if thermal extremes be avoided.
Carious defects, as such, are of no consequence.	The tooth usually shows a carious defect.
The mandibular lymph nodes A, B, C or D are swollen, tender and painful on pressure. (See page 213.)	Swelling of the mandibular lymph nodes is not observed.

Treatment.—Removal of the cause is of prime importance. If the disturbances result from mechanical causes they usually yield readily to treatment after the causative factors have been eliminated. Painting of the affected surfaces with an iodine solution (Talbot's iodo-glycerol) as a palliative measure is of some service. If the disturbances are of chemical origin, *i. e.*, arsenic, phosphorus, etc., they are treated as outlined under their respective headings.



Schematic drawing of the relationship of the submaxillary and the submental lymph nodes to the teeth of the upper and the lower jaw. *A*, *B* and *C* = submaxillary lymph nodes; *D* = submental lymph nodes.

The disturbances about the apex of a tooth require prompt removal of the accumulated putrid masses from the root canals. The latter are to be opened to allow free drainage. To avoid unnecessary severe pain, stability of the tooth is essential (traction is made with a string; plaster of Paris or modeling compound splints); scarification of the highly inflamed gum tissues is of benefit, while in the early stages ice chips held between the gum and the cheek are helpful in reducing inflammation.

If pus collects about the apex and no ready drainage is obtained, very intense pain is the direct sequence. An endeavor should be made to drain the pus through the root canal (blind abscess). If this is not possible, an opening is made through the gum tissue and the bone with a fissure bur or a small tubular knife, and an artificial fistula is established. If the disturbance is left alone, Nature helps herself; the pus may burrow through the bone and gum tissue along the line of least resistance, or along the pericementum toward the gingival line. As soon as free drainage is obtained the pain is much mitigated; it may often stop completely. (See Alveolar Abscess.) With the successful treatment of the infected root canals and proper filling, the fistula will close in due time and the pericemental disturbances disappear. If, on the other hand, a diffuse pus infiltration of the entire pericementum results, recovery is not to be expected; the tooth has to be removed. Occasionally we find teeth, usually multi-rooted teeth, where the root fillings have not been successfully placed and remnants of putrid matter are left about the apices and, as a sequence, the pericementum is kept in a chronic state of inflammation. Such teeth are a continuous source of trouble. The slightest disturbance (cold, influenza, mental or physical strain) may set up a renewed severe acute inflammation with all its sequences. It is then best to remove the root filling, treat the canals antiseptically and again restore the filling. Resection (amputation) of the root is the most promising procedure.

℞—Dichloramine-T		gr. iv
Chlorcosan.		fl.ʒj

Sig.—Mechanically evacuate the pus and, on a sterile paper cone, hermetically seal in the canal for twenty-four hours; repeat two or three times.

℞—Phenol. cryst.	āā	ʒij
Thymolis		
Camphoræ		ʒj—ɱ

Sig.—Seal into root canal.

℞—Zinci iodid.		℥j
Iodi		ʒv
Glycerini		fl.℥j
Aquæ	q.s. ad	fl.℥iv—ɱ

Sig.—Paint upon the gum surfaces of the affected tooth.

℞—Tinct. aconiti	āā	fl.ʒij
Tinct. iodi.		
Chloroformi		fl.ʒj—ɱ

Sig.—Paint upon the gum surfaces of the affected tooth.

℞—Tablet. acid. acetyl-salicyl. . . . gr. v
No. vi.

Sig.—One tablet every two hours with a tumblerful of water.

℞—Magnes. sulphatis . . . . . . ℥j
Acid. sulphur. dil. . . . . . . fl.ʒss
Syr. limonis . . . . fl.℥j
Aquæ . . . . . . q.s. ad fl.℥iv—m

Sig.—A tablespoonful in half a glassful of water every three hours until free movement of the bowels is established.

Phosphorus Necrosis.—This disease is rare at present on account of improved hygienic conditions in match and chemical factories. Rigid prophylaxis is the best preventative.

Symptoms.—Intoxication is very slow, extending over months. Carious teeth are the main gates of entry of the phosphorus gases; it is primarily located in the lower jaw. Severe pain, periostitis, loosening of teeth, osteomyelitis and finally necrosis, which often involves the entire mandible, are the results.

Treatment.—Resection of the involved bone along the line of demarcation; packing with iodoform gauze and rigid antisepsis. Patient must keep away from factory; nutritious food and tonics are recommended (milk, cod-liver oil, beef, wine and iron).

℞—Fl. extr. cascara sagrada . . . fl.℥j
Liquor ferri pepto-mangan. q.s. ad ℥xij—m

Sig.—Tablespoonful three times daily, an hour after meals.

Pulpitis (*Inflammation of the Pulp*).—Hyperemia.—The pulp is hypersensitive; heat and cold produces short acute, but very pronounced expression of pain.

Causes.—Irritation brought about by chemical, physical or mechanical agencies, *i. e.*, through a carious defect or through the exposure of a tooth root. Heat, resulting from the too rapid rotating of a disc in finishing a filling frequently produces a prolonged hyperemia.

Treatment.—If the irritation results from the sequences of a carious defect, the cavity should be excavated; antiseptics, *i. e.*, phenol, thymol, eugenol, etc., are applied and a temporary filling is inserted. If hyperemia results from an exposed root, the application of silver nitrate in the form of a concentrated solution or in substance upon the surface of the root gives temporary relief.

℞—Chloreton.	gr. xx
Ol. caryophyll.	fl.ʒj—♏

Sig.—Seal into the cavity for forty-eight hours.

ACUTE PULPITIS, PARTIAL AND TOTAL.—If the pain of the pulp is persistent, *i. e.*, from several hours to several days, a more or less severe inflammation of the pulp is present; a minute exposure may frequently be located upon close examination.

Treatment.—In the teeth of the young an effort should be made in the early stage of the inflammation to preserve the pulp by palliative treatment. Astringents and antiseptics are applied and the bottom of the cavity is lined with a non-conductive varnish prior to inserting the temporary filling. This filling must remain from one to six months. In the adult it is usually better practice to destroy the pulp at once and replace it by an aseptic root filling.

SUPPURATIVE PULPITIS, PARTIAL AND TOTAL.—Diffuse, continued pain upon the side of the face where the tooth is situated. Pain usually increases upon assuming a recumbent position. This form of pulpitis frequently results from cement and other fillings placed over an unobserved small exposure.

Treatment.—On penetrating into a pulp chamber containing a suppurating pulp with a bur, practically no pain is experienced; occasionally, however, a very short paroxysm may be observed. On withdrawing the bur, the pent-up pus wells up, followed by a drop or two of dark blood. The violent pain which the patient has suffered for hours or days ceases almost instantly. The pulp chamber should be opened as widely as possible and washed out with tepid water. A broach may now be inserted to ascertain whether the whole or only a part of the pulp has succumbed to the infection. In the former case immediate extirpation of the necrotic pulp débris is indicated. A dressing of dichloramine-T is sealed into the empty root canal. The subsequent treatment of such root canals is discussed under "Necrosis and Gangrene."

HYPERPLASTIC PULPITIS, CHRONIC, also known as pulp polypus, is a chronic productive inflammation of the exposed pulp characterized by a slowly growing granulation tissue upon its surface, filling more or less the carious cavity and sometimes protruding therefrom.

Treatment.—The treatment of chronic hyperplastic pulpitis consists in the preliminary surgical removal of the granulation tissue and destruction of the remaining pulp. To facilitate the painless amputation of the polypus a drop of liquid phenol is allowed to flow upon it and very shortly the cauterized head, which now appears as a milk-white bead, may be cut off with a sharp spoon curette or a hatchet-shaped excavator, or with a small curved lancet. Profuse bleeding results. The further treatment consists in the removal of the remaining pulp, etc., to be carried out in the usual manner.

NECROSIS AND GANGRENE OF THE DENTAL PULP.—Necrosis and gangrene of the dental pulp may be brought about by its death from any cause and by simultaneous or subsequent putrefaction which in turn results in an infected root canal.

The treatment of an infected root canal resolves itself into three definite phases: The mechanical, the chemical and the therapeutic procedures. Mechanical manipulations are intended to dispose of the débris of the decomposed pulp and to assist in the enlargement of the canal. Chemical procedures are primarily applied for the purpose of facilitating the removal of obstructions, and therapeutic applications are utilized to overcome septic conditions. The successful removal of the débris from a root canal depends primarily upon its size. Curvatures of the roots and the presence of secondary dentin materially increases the difficulties. During the process of enlarging the canals numerous complications may arise among which the packing of débris into the apical region of the very fine canals, cutting ledges into the walls of the curved canal and breaking the tip of a broach near a curve are relatively common occurrences. Binding of the broach within the canal must be rigidly avoided, as breaking of this delicate instrument by applying undue force is almost certain to occur. If a ledge is cut, which is usually the result of using too large a broach, it must be carefully filed away, otherwise the formation of a pocket and finally the perforation of the wall of the root is very apt to take place. By alternating the various sized picks and broaches the canal is finally cleansed of its débris and the apical foramen is brought within reach. With suitable Kerr files the canal may now be enlarged and straightened so as to assume a conical shape which may materially assist in placing the gutta-percha cone simultaneously against the wall and the apex.

For the chemical disintegration of the pulp detritus, but primarily for the purpose of assisting in the opening of obliterated root canals two specific methods are in vogue, *i. e.*, the alkali and the acid method. The alkali method tends to destroy the organic constituents of the calcareous deposits and incidentally to assist in the dissolution of necrosed tissue by means of the freshly formed hydroxides of potassium and sodium derived from an alloy of potassium and sodium in the presence of water, and thereby rendering the remaining inorganic débris more friable and offering less resistance to the advancing instruments, while the sulphuric acid treatment produces the opposite effect, *i. e.*, it destroys the inorganic substances by dissolution and carbonizes the remaining organic material. The most satisfactory results are obtained by the use of potassium-sodium alloy or by the combined application of the alkali and acid methods in logical sequence, *i. e.*, sodium dioxide followed by sulphuric acid and finally by copious washing with water.

For the therapeutic treatment of the infected root canal the application of a 5 per cent solution of dichloramine-T at intervals of three or four visits has proven to be eminently successful. After thorough disinfection the canals are filled aseptically. (For the devitalizing compounds, antiseptics, root-filling materials, etc., used in this connection see Pharmaceutical Compounds, Chapter VII.)

Pyorrhea Alveolaris.—Precocious senile atrophy of the alveolar process of the jaw bones accompanied by progressive loosening of the involved tooth and subsequent infection and suppuration of its retentive tissues.

Causes.—Local: Salivary calculus, chronic irritation from ill-fitting dentures, distorted articulation, orthodontic appliances and other sources. *General:* Gout, rheumatism, diabetes mellitus, locomotor ataxia and other constitutional diseases; metal poisoning and, probably, predisposition.

Symptoms.—The disease begins with a slight loosening of the affected tooth, gingivitis and subsequent formation of a pocket. Pus is not always present in the early stages; later it may be dislodged by pressure upon the pocket. The gingivæ become detached from the tooth and necrosis of the alveolus follows. There is little fetor from the mouth; the disease usually produces little inconvenience to the patient in the earlier stages.

Treatment. The removal of all deposits from the roots with suitable instruments is of prime importance. The pockets are washed out with hot antiseptic solutions and cauterized. Trichloracetic acid, 10 to 25 per cent, aromatic sulphuric acid, a saturated solution of copper sulphate in hot lactic acid, etc., are to be recommended. Loose teeth are ligated to their sound neighbors or held in permanent position by fixed metal splints. Articulation is restored and the mouth is brought into a hygienic condition. The gums are saturated with Talbot's zinc iodide solution and frequently massaged. The continuous use of astringent and antiseptic mouth washes are highly indicated.

Uric acid diathesis is held by some writers to be the sole cause of pyorrhea alveolaris. The copious drinking of water, especially weak alkaline water (lithia) together with a well-regulated diet and proper hygienic measures will be of marked benefit.

As a solvent of the uratic tophi hexamethylene, also known as urotropine, etc., is recommended. If the underlying cause is a general disease the coöperation of the family physician should be secured.

℞—Lithii citratis . . . . gr. v
Tablet, No. L.

Sig.—One tablet dissolved in a tumblerful of water four to five times a day.

Shock.—Sudden vital depression due to injury or emotion making an untoward impression upon the nervous system. Its severity depends upon the cause, *i. e.*, it may be slight, transient, profound or even fatal. Recovery is followed by more or less quickening of the pulse and the respiration and an abnormally high temperature.

Treatment.—It requires prompt attention. The body is placed in a recumbent position with the head lowered and the patient is wrapped in warm blankets and hot-water bottles are placed about the extremities. Quickly acting stimulants, viz., whisky or brandy by the mouth or hypodermically in 0.5 to 1-dram doses should be given very freely, assisted by strong, hot coffee. The heart is supported with digitalis and atropine. When there has been much hemorrhage copious draughts of hot liquids are indicated. Recovery from shock, if it occurs at all, is usually quite speedy.

Stomatitis, Aphthous.—Primarily a disease of childhood. Small, round ulcers of a grayish color surrounded by a red, narrow border; occasionally three or four ulcers will coalesce to a larger one. It is found principally upon the surfaces of the tongue and upon the buccal mucosa. Especially prone to be present at the time of the first dentition; less frequently in the adult.

Symptoms.—Painful and burning mouth; slight fever. The salivary secretions are increased. Usually, in ten to fifteen days the ulcers disappear without leaving a scar.

Treatment.—Perfect cleansing of the child's mouth and the utensils employed in nursing. Washing of the mouth with a 2 per cent boric acid solution or with mild astringent mixtures. Use the finger, wrapped with cotton cloth and dipped into the warmed solution. An 8 per cent solution of zinc chloride used as a caustic upon the ulcers is the supreme remedy. Keep the bowels open.

℞—Zinci chloridi		gr. xxxv
Aquæ destil.		fl.℥j—M

Sig.—Apply upon the ulcers with a small piece of cotton wrapped about the point of a wooden applicator.

℞—Glycerol. acidi tannici		fl.ʒij
Aquæ	q.s. ad	fl.℥j—M

Sig.—To be painted upon the inflamed spots.

℞—Acidi borici		ʒij
Glycerini		fl.℥j
Aquæ	q.s. ad	fl.℥iv—M

Sig.—A tablespoonful in a tumblerful of warm salt water as a mouth wash.

Stomatitis, Catarrhal (*Acute or Chronic. Follicular Stomaitis. Inflammation of the Mucous Linings of the Mouth*).

Causes.—Neglected mouth hygiene; ragged edges of teeth; calcareous deposits or secondary expressions of general diseases, *i. e.*, influenza or other infections, anemia, and during pregnancy.

Symptoms.—Red and swollen mucous linings, increased salivation, thickened papillæ and turgid gums. The tongue is usually swollen and coated and shows the imprints of the teeth. A pronounced fetor from the mouth exists with painful deglutition and speech; fever is more or less present.

Treatment.—Clean up the mouth; smooth all ragged edges about the teeth; loose roots must be removed. Smoking is to be prohibited. If artificial dentures are worn they should be temporarily removed. The bowels should be kept open by a saline purge; the gum edges are cauterized with copper sulphate in substances and rigid mouth hygiene is enforced.

℞—Magnesii sulphatis		℥j
Acidi sulphur. dilu.		fl.ʒss
Syrup. limonis		fl.ʒj
Aquæ	q.s. ad	fl.℥iv—♏

Sig.—A tablespoonful in half a glass of water every four hours.

℞—Acidi benzoici		ʒj
Tinct. krameriæ		fl.℥ss
Ol. menth. pip.		gtt. xv
Alcohol.	q.s. ad	fl.℥iv—♏

Sig.—A teaspoonful in a glassful of warm salt water as a mouth wash.

Stomatitis, Gangrenous (*Noma*; *Cancrum Oris*; *Water Cancer*).—An acute, rapidly progressive gangrenous ulceration of the mouth, leading to extensive sloughing and destruction of the affected parts. It is brought about by an infection which is probably specific in its nature. The disease progresses very rapidly; it is accompanied by an intense fetid odor and nearly always ends fatally. Its treatment belongs to the domain of the surgeon.

Stomatitis, Scorbutic (*Scurvy*).—General malnutrition or anemia brought about by an infection resultant from dietary insufficiency of fresh vegetables (absence of certain vitamins). The gums are much swollen, spongy and ready to bleed upon the slightest irritation. Malaise, debility and mental lethargy are pronounced. Refer to the physician for the treatment of the general condition.

Stomatitis, Ulcerative.—Various forms of severe disturbances of the soft tissues.

MERCURIAL STOMATITIS.—This results from the internal administration of mercury or from inhalation of mercury vapors. Usually starting about the posterior teeth, more so if ragged tooth structure is a source of irritation. The gums are much swollen and loosened from the teeth; the teeth are loose and covered with a thick, slimy sordes of intense foul odor; salivation is much increased. Ulcerous destruction of the gum tissue terminates in gangrene. Caries and necrosis of the alveolar process and jaw bones may be the result.

Treatment.—All mechanical disturbances have to be removed from the mouth; loose teeth and useless roots are extracted and the mercury treatment has to be stopped temporarily. Smoking and spiced or acid foods are prohibited. Thorough hygiene of the mouth is of prime importance. Hydrogen peroxide in combination with a metal astringent is the sovereign remedy for this affection. The much lauded potassium chlorate administration is of doubtful value. In severe cases of ulceration iodoform or its odorless substitutes applied upon the corroded surfaces are of much benefit.

℞—Zinci chloridi		gr. x
Resorcinolis		ʒj
Thymolis		gr. xx
Glycerini		fl.℥j
Alcoholis		fl.℥ij
Aquæ hydrog. dioxidi .	q.s. ad	fl.℥viij—M

Sig.—A teaspoonful in a glassful of warm salt water every hour as a mouth wash.

℞—Iodoformi	ʒj
Glycerini	fl.℥ij—M

Sig.—To be painted upon the ulcerated surfaces.

Ulcero-membranous Stomatitis, (*Ulcerative or Gangrenous Gingivo-stomatitis; Vincent's Angina; "Trench Mouth"*). —An acute highly infectious disease of the oral mucosa caused by the so-called Plaut-Vincent organisms, *i. e.*, a symbiosis of Bact. fusiformis and Spirochæte refringens. The gums are swollen and congested and at times; the gingival margin has undergone ulceration and sloughing. The ulceration may involve the hard and soft palate, tonsils, mucous membrane of the cheeks, the tongue and, on rare occasions, the floor of the mouth. The ulcers are covered with a yellowish-white necrotic scum, which when removed leaves a bleeding, highly sensitive surface. The breath is fetid and there is some fever, with malaise, considerable pain, sleeplessness, loss of appetite, thirst, salivation, difficult deglutition, etc., with more or less severe symptoms of toxemia. The early characteristic sign is the sloughing of the interdental papillæ followed by their permanent destruction.

Treatment.—Treatment should be primarily directed against the removal of the predisposing causes, viz., calcareous deposits upon the teeth, foul roots, abscessed teeth, etc. Predisposition to this disease is much favored by local disturbances arising within the oral cavity, which lower the normal vitality of the mucous lining (abuse of tobacco, etc.) and by an unbalanced metabolism (canned food, etc.). Thorough cleansing of the ulcerated surfaces with 3 per cent hydrogen peroxide combined with copious hot irrigation of the mouth with a weak potassium permanganate solution or 1 per cent hydrogen peroxide at frequent intervals combined with massage of the gums and hygienic care of the teeth is imperative. In the milder types application of zinc chloride solution (8 per cent) is useful: The supreme remedy in severe cases is 10 per cent chromic acid solution. The general health of the patient must be carefully considered. Recurrent attacks are rather frequently observed. As this disease is highly infectious, the patient should be cautioned to exercise the greatest care to prevent its spreading.

℞—Acidi chromici . . . . gr. xl
Aquæ destil. . . . . fl.℥j—♏

Sig.—Apply with a cotton swab upon the ulcerated surfaces.

Swallowing Artificial Dentures.—Artificial dentures, like other foreign bodies, may accidentally be swallowed. The following points should be carefully observed in the construction of dentures: (1) Great care should be exercised in regard to fastening dentures in the mouth. (2) It is best to advise the patient to remove such substitutes during sleeping hours. (3) Epileptics should quickly remove the artificial teeth in the beginning of an attack (aurea epileptica). (4) Before administering a general anesthetic, artificial substitutes must be removed from the mouth. (5) Dentures should not be made too small and too many clasps and sharp corners should be avoided.

Diagnosis.—The esophageal probe and the roentgen ray are sure means.

Treatment.—If the denture is caught in the pharynx the coin catcher or other suitable instrument may help to extract it. If lodged in the esophagus it may be possible to gently force it into the stomach by means of a sound. If lodged in the stomach or the intestines an attempt should be made to facilitate the removal of the denture through the natural way, viz., the intestines. The patient should eat large quantities of asparagus, oatmeal porridge, boiled rice or mashed potatoes, mixed to a thick mush with milk and white crochet cotton cut in pieces about two inches long. The meal should be repeated every three hours and this diet may be continued for several days. After the third or fourth day, half an ounce of castor oil is administered. Avoid purgatives in the beginning. The object is to distend the intestines and to entangle the denture in the cotton threads. If the stomach or the bowels persist in retaining the denture an operation should be resorted to.

Syncope.—A more or less sudden failure of the heart; extreme state of prostration.

Treatment.—Fresh air, horizontal position of the patient, opening of obstructing garments and massage of the heart; dashing of cold water in the face and irritating substances, like ammonia (smelling salt) and amyl nitrite, for inhalation.

Syphilis of the Mouth.—The hard chancre (Hunterian) is the typical initial lesion of syphilis which usually appears about three weeks after infection at the point of inoculation.

It is more typical in men than in women. It is a definite round or oval ulcer, having a sharply defined border and presenting a corroded surface which is covered with a whitish lard-like detritus and which secretes a thin serous fluid. The edges are often ragged and undermined. Swelling of the neighboring lymph glands occurs in the early stages of the disease. Of all extragenital chancres, 65 per cent are located about the mouth (lips, throat, tongue and buccal cavity). The secondary manifestations appear from four to eight weeks after the initial lesion and are ushered in with fever, malaise and headache. A typical sore throat makes its appearance early. The diagnosis is often difficult in the early stages; the presence of certain skin eruptions (roseola) and the mucous patches make the diagnosis certain.

There are several points which all syphilides have in common, and which, taken together, may be considered as pathognomonic of syphilis.

"1. Syphilitic rashes or syphilides are superficial. They are situated in the capillary layer or the corium of the skin and extend only superficially. There is no tendency, as in tertiary lesions, to extend into the deep tissue, and very little tendency to increase peripherally, though two or more closely situated lesions may coalesce.

"2. It is only the epidermis overlying the syphilides that is destroyed and it is replaced by new epithelium.

"3. If the lesion is not contaminated by pus cocci there is no tendency to ulcerate.

"4. The epidermis is replaced and does not leave a scar.

"5. There is, however, a deposit of pigment where the syphilide occurred, which is of a characteristic ham or copper color. This spot may disappear very shortly, leaving no trace. It may appear immediately or its appearance may be delayed a few days.

"6. Syphilitic rashes may or may not itch.

"7. They are symmetrical on both sides of the body.

"8. The roseola disappears on pressure.

"The mucous patch develops upon mucous surfaces of the skin and it is similar in structure to a papule, but it secretes a glairy fluid which is highly infective. If inoculated into

Differential Diagnosis.

SYPHILITIC SORE THROAT.	ACUTE TONSILLITIS.
History of infection.	No specific history.
Inflammation slight.	Inflammation much greater.
Little swelling.	Much swelling.
Slight rise in temperature.	Temperature high.
Little pain.	Pain very severe.
No difficulty in swallowing and opening mouth.	Difficulty in opening mouth and swallowing.
Symmetrically disposed.	Usually unilateral.

SYPHILITIC SORE THROAT.	TUBERCULAR SORE THROAT.
Syphilitic history.	Tubercular history. No syphilitic history.
May be in children; if so, hereditary.	Usually adults.
No emaciation.	Rapid emaciation.
Little fever and pain.	High fever, much pain.
Hoarseness; no dysphagia or aphonia.	Aphonia, dysphagia, dyspnea.
Ulcer sharply defined with edges.	Ulcer, superficial, indefinite edges, not undermined.
Undermined.	Grayish perforated appearance.
Situated on a thickened base with surrounding area of redness.	Progresses rapidly.
Duration brief.	Anemic mucous membrane.

SYPHILITIC ULCER OF TONSIL.	CANCER OF TONSIL.
Swelling and induration slight.	Much swelling and induration.
Usually bilateral.	Usually unilateral.
Syphilitic history.	No history of syphilis.
Ulcer has indurated base.	No indurated base.
Edges sharply defined, undermined.	Edges not undermined, grayish.
May be superficial or deep.	Profuse granulations.
Little or no pain.	Pain very severe before and after ulceration.
No cachexia.	Cachexia marked.
Discharge not so offensive.	Fetid discharge.

MUCOUS PATCHES.	LEUCOPLAKIA BUCCALIS.
Duration short.	May last for years.
Round or oval, smaller.	Form irregular, may grow quite large.
Seldom on cheek.	Frequently on cheek.
Often on tip, margin and under surface of tongue.	Never found in these locations.
Patches thinner.	Patches thickened.
Glands involved.	If involved, only later.
No carcinomatous tendency.	Tendency to develop into carcinoma.
Patches grayish or red.	Patches very white.

(L. B. Baldwin.)

a healthy person a chancre will always result at the point of infection. Mucous patches are not painful and seldom give rise to inconvenience. In the mouth the first manifestation of the secondary stage of syphilitic infection is the appearance of a general dull red erythema involving the entire fauces. The erythema soon fades, leaving symmetrically disposed erythematous spots on both sides of the palate, the walls of the pharynx, the pillars of the fauces and sides of the tongue."

Tertiary manifestations may occur from two to three years or even fifteen years after the primary infection. Gummata, viz., small defined accumulations of cells, which show a tendency to break down into ulcers and destroy surrounding tissues. The gummata of the palates destroy the soft and hard portions equally rapid; necrosis of the bone results. The ulcer finally heals but leaves a round perforation which communicates with the nasal cavity. Hereditary syphilis is characterized by typical imperfections of the permanent teeth usually confined to the upper incisors; they present crescent-like peculiar excavations at their incisive edges and they, with the other teeth, may show pitted surfaces, irregularity of position and, in general, weak structure. Pathognomonic signs of inherited syphilis are: The presence of malformed teeth, interstitial keratitis and otitis media (Hutchinson's triad).

Treatment.—It is to be left to the physician. The oral cavity of the syphilitic should be brought in perfect order before medicinal treatment is inaugurated. This factor will, to a very large extent, prevent the possible occurrence of mercurial stomatitis. The teeth should be scrupulously cleaned and kept in that condition during the treatment; all useless roots are removed and present cavities filled. The frequent use of astringent and antiseptic mouth washes are essential. The greatest care is to be exercised by the operator to work with sterilized instruments only to prevent a possible infection of himself or of his patients. All instruments used during treatment must be sterilized by boiling.

Thrush (*White Mouth; Soor; Muguet; Parasitic Stomatitis*).—An inflammation of the mucous lining of the mouth from a parasitic fungus, oïdium albicans, manifesting itself in pain, disturbed deglutition, disorders of digestion and of the bowels.

Symptoms.—The mucous lining of the oral cavity is covered with a whitish thick deposit which may be lifted up by an instrument. Thrush fungi are seen on microscopical examination. The pain varies with the severity of the disease.

Treatment.—Absolute cleanliness of the mouth, alkaline mouth washes and painting of the affected surfaces with borax or salicylic acid solutions.

℞—Sodii boratis		ʒij
Glycerini		fl.℥ss
Aquæ	q.s. ad	fl.℥j—♏

Sig.—Apply with a cotton swab three or four times daily.

℞—Acidi salicylici		gr. xxv
Alcoholis		fl. ʒij
Glycerini	q.s. ad	fl℥j—♏

Sig.—Paint upon affected surfaces three times daily.

Tumors of the Mouth.—All forms of tumorous growths are found in the mouth. Upon the gums giant-cell sarcomatous growths, known as epulis, are especially prone to occur. Usually they have their origin in the periosteal lining of the alveolus, and they are benign in their nature. Sarcoma and carcinoma are rarely found upon the gums proper. From the periosteum may develop fibromas, myxomas, sarcomas, carcinomas, cysts, etc. In the floor of the mouth retention cysts are occasionally observed. (See Cysts.)

Treatment.—Epulis is usually pedunculated; it is removed with the knife or by the galvanic cautery, care being taken to destroy the peduncle at its starting point, otherwise it will recur in a short time. (For the treatment of the retention cysts, see Cysts.)

Treatment of all larger tumors of the oral cavity are to be referred to the surgeon.

Wounds.—Wounds are breaks in the continuity of the tissues. They may be incised, as made by a cutting instrument; lacerated, resulting from crushing or tearing; or penetrating, as made by a pointed instrument. Wounds frequently become infected.

Treatment.—General: To stop the hemorrhage, tie the vessels or pack the wounds; remove crushed or lacerated tissues and close the wound by a suture or by a protective (collodion, adhesive plaster). Infected wounds with pus formation require prompt incision and evacuation of the purulent matter. Remove detritus by syringing and, if necessary, with a curette. Dress with wet hot gauze soaked in solution of phenol, 2 per cent, or mercuric bichloride, 1 in 5000. Wounds in the mouth heal comparatively readily; antisepsis should be rigidly enforced.

IMMEDIATE TREATMENT OF ACUTE POISONING

General Directions.

When a poison has been swallowed, the stomach should at once be evacuated with the stomach tube, or, in its absence, with a fountain syringe. If corrosives have been swallowed and the mucous membranes are greatly swollen, the stomach tube is not indicated, as laceration of the soft tissues may follow. Emetics are of prime importance. Certain metallic salts, especially copper sulphate in 3-grain (0.2 gm.) doses, and zinc sulphate in 10-grain (0.65 gm.) doses, dissolved in a glassful of water, act very promptly. If the patient is unable to swallow, apomorphine hydrochloride, $\frac{1}{10}$ grain (0.006 gm.), hypodermically, acts promptly and vigorously. As an emergency remedy a tablespoonful of ground mustard stirred in a cupful of tepid water usually produces quick vomiting. If the poison is of an unknown origin, emetics, bland liquids and stimulants, together with suitable systematic treatment, is indicated.

Acetic, Hydrochloric, Nitric, Nitro-hydrochloric and Sulphuric Acids.

No emetic should be given. To dilute and neutralize the acid, milk mixed with chalk, whiting, magnesia, or baking soda, strong soap suds, or white of egg beaten up with water, is given; later oil and mucilaginous drinks of flaxseed or slippery elm are indicated. Usually intense ulceration follows the acid burns. To relieve pain, morphine sulphate $\frac{1}{4}$ grain (0.015 gm.), or tincture of opium, 15 drops (1 cc), is administered.

Hydrocyanic Acid and All Cyanides, Alcohol, Chloroform, Ether, Chloral Hydrate, Gasoline, Carbon Bisulphide and Sulphurets of the Alkalies.

Hydrocyanic acid and cyanides require very prompt measures; they are quick and powerful poisons. Emetics may be given if necessary. The patient is put in a recumbent position, the head lowered and plenty of fresh air for free respiration. Persistent artificial respiration should be instituted if needed. Keep the body warm and try to arouse the patient with ammonia vapors; put cold douches to his head and apply friction to the extremities. Strong stimulants—whisky, nitroglycerin solution in $\frac{1}{2}$ drop doses, etc.—are indicated.

Oxalic Acid and Its Salts.

Give chalk or whiting mixed with two tablespoonfuls of vinegar and an equal quantity of water; do not give soda or potash with the object of neutralizing the acid. Vomiting should be induced at once and followed by olive oil or mucilaginous drinks. General stimulants—whisky, etc.—and warmth applied to the extremities are essential.

Phenol (Carbolic Acid) and Its Compounds, Cresol, Creosote, Lysol and Resorcinol.

Induce vomiting and give large quantities of diluted whisky or magnesium sulphate solution in the early stages. Remember that alcohol is not a chemical antidote for phenol or its compounds. Later give bland liquids, olive oil and general stimulants as required.

Caustic Alkalies and Ammonia.

Promote vomiting by large draughts of warm water. Mild acids in the form of diluted vinegar or lemon juice are indicated, which should be followed by olive oil, white of egg beaten up with water and mucilaginous drinks. Severe pain calls for morphine sulphate, $\frac{1}{4}$ grain (0.015 gm.) or tincture of opium, 15 drops (1 cc).

Arsenic and Its Compounds.

Promote vomiting with large draughts of warm water and administer at once hydrated oxide of iron (the official antidote for arsenic) or dialyzed iron. The official antidote may be prepared extemporaneously by mixing a teaspoonful of calcined magnesia with a cupful of water, add 3 teaspoonfuls of tincture of iron chloride, mix well and give the whole of it at once. This is to be followed with olive oil, white of egg beaten up with water and mucilaginous drinks.

Antimony Salts, Copper, Iodine and Its Preparations, Mercury Salts, Potassium Bichromate, Tartar Emetic, Tin and Its Salts, Colchicum, Cantharides and the Oils of Croton, Savin and Pansy.

Induce vomiting and it is usually produced by the metallic salts themselves. Give large draughts of raw white egg (about half dozen or more) beaten up with water, or flour stirred in water, strong tea or coffee and general stimulants. To relieve pain and tenesmus, morphine sulphate, $\frac{1}{4}$ grain (0.015 gm.) is indicated.

Barium and Lead Salts.

Give magnesium sulphate, 4 drams (15 gm.) or sodium sulphate, 1 ounce (30 gm.), dissolved in a large tumblerful of water. Promote vomiting by warm water or with mustard and follow with milk and demulcent drinks. Pain is relieved by morphine sulphate, $\frac{1}{4}$ grain (0.015 gm.) or tincture of opium, 15 drops (1 cc).

Silver Nitrate.

Give common salt, one-half tablespoonful dissolved in a tumblerful of warm water and induce vomiting; later, large draughts of demulcent drinks—starch, flaxseed or slippery elm stirred in water—are indicated.

Phosphorus (Rat Paste, Etc.).

Give a prompt emetic—copper sulphate, 3 grains (0.03 gm.), dissolved in a tumblerful of water—every five minutes. Old, thick oil of turpentine in 1-dram (4 cc) doses, suspended in flour water and repeated every hour, is much lauded. Do not give oils or fats. Milk of magnesia is often beneficial. When indicated give general stimulants.

Atropine, Cocaine, Gelsemine, Pilocarpine and All Preparations Containing These Alkaloids.

Induce vomiting, give large draughts of warm water, strong coffee and tea and general stimulants. If the patient is drowsy, rouse him with ammonia vapors; apply heat to the extremities and institute artificial respiration if necessary.

Aconite, Cotton Root, Digitalis, Ergot, Lobelia, Tobacco, Veratrum and Preparations Containing These Substances.

Give an emetic, which should be followed by large draughts of warm water, strong tea or coffee. Keep the patient in a horizontal position, apply warmth and friction to the extremities and use artificial respiration if needed.

Opium and Its Preparations, Morphine and Its Salts and Indian Hemp.

If necessary, vomiting should be induced. Give strong tea or coffee and large draughts of warm water. Keep the patient awake and, if possible, in motion. A cold douche is beneficial. Strychnine sulphate, $\frac{1}{30}$ grain (0.002 gm.) and atropine sulphate, $\frac{1}{100}$ grain (0.0006 gm.), administered hypodermically, are often of benefit. Persistent artificial respiration should be kept up, even after life seems to be extinct.

Nux Vomica and Its Preparations, Strychnine and Its Salts and Fish-berries (Cocculus Indicus).

Induce vomiting, followed by large draughts of warm water, and give tannic acid in 1 per cent solution or iodide of starch. Spasms are relieved by inhalation of chloroform or by chloral hydrate, 15 grains (1 gm.), dissolved in a tumblerful of water. Evacuate the bowels and give the patient absolute rest.

Formaldehyde and Its Solutions.

Give ammonia in very diluted solutions and demulcent drinks. General stimulants should be given when indicated.

Wood Alcohol.

Give immediately a tablespoonful of common salt, dissolved in a large tumblerful of warm water, and repeat with strychnine sulphate, $\frac{1}{30}$ grain (0.002 gm.), hypodermically and give strong coffee or tea.

Decayed Meat or Vegetables.

These materials are often productive of ptomaine poisoning. Induce vomiting and cleanse the bowels with full doses of castor oil. Strong stimulants and heat and friction applied to the extremities are beneficial.

Poisonous Fungi.

Evacuate the stomach as quickly as possible by promptly acting emetics. Give atropine sulphate, $\frac{1}{100}$ grain (0.0006 gm.), hypodermically and tannic acid in the form of strong tea or coffee.

URINE ANALYSIS.

Urine analysis as an aid in diagnosticating certain dental diseases is an essential adjunct to the clinical examination of the patient. Oral manifestation of typical general diseases—as diabetes, gout, autointoxication, etc.—are often the first pathognomonic signs of these diseases. The correct diagnosis of the latter is verified by a urine analysis and the patient may be surprised to learn that the presence of an odor of acetone from the oral cavity, together with the formation of pericemental abscesses and the rapid accumulation of soft white calcareous deposits about the teeth should be indicative of diabetes, of which he has no knowledge at the time. The presence of sugar in the urine will verify the diagnosis. A urine analysis is also of important value to the dental practitioner if he intends to administer a general anesthetic—chloroform or ether—to a patient. For the foregoing purposes an exhaustive examination of the urine is not necessary; it is merely intended to ascertain by a few simple tests the presence or absence of albumin, of sugar, of the approximate amount of uric acid, etc. The determination of these substances may also indicate if the assistance of the family physician is desired in the treatment of the case under observation. An intelligent report made to the physician will not merely insure the coöperation of the latter, but may also assist in bringing about a better understanding and a much desired closer relationship of the two professions.

The normal quantity of urine voided in twenty-four hours varies from 40 to 50 ounces (1200 to 1500 cc). Free perspiration decreases the quantity, while chilling of the skin increases it. The greatest portion of urine is passed during the day; during the night and the early morning hours the least portion is passed. Usually the urine has a light, amber color, due to urobilin; the color depends, however, largely on the quantity voided. On standing, nearly all normal urine assumes a cloudy appearance, which is due to the presence of mucus. The normal reaction of urine is slightly acid, due to uric acid, hippuric acid, or acid sodium phosphate. After meals the reaction may be neutral or even alkaline for a short time. The normal specific gravity varies from 1.015 to 1.025; it is low when an increased amount is passed and high when the quantity is diminished. Normal urine has a peculiar, aromatic odor; it is altered by certain foods or drugs—asparagus and oil of turpentine produce a violet-like odor, garlic gives a garlic-like odor, etc.

The solid constituents of urine consist of organic and inorganic compounds and they vary very markedly. The solids held in solution by and excreted with the urine within twenty-four hours amount to approximately:

308 to 617 grains (20 to 40 gm.) urea.
6 to 12 grains (0.36 to 0.78 gm.) uric acid.
9 to 14 grains(0.54 to 0.90 gm.) ammonium, calcium, magnesium, potassium and sodium urate.
12 to 45 grains (0.72 to 2.9 gm.) sodium phosphate.
154 to 237 grains (10 to 25 gm.) sodium chloride.

General Examination.

For the examination of the urine the mixed total quantity voided during the twenty-four hours or a part thereof should be submitted. The preliminary inspection begins with the color of the sample; the latter may be expressed as pale straw, straw, pale amber, amber, dark amber, reddish amber, etc., or after Vogel's scale of colors. It should not be forgotten that certain drugs which are taken internally may impart a distinctive color to the urine—santonin produces an intense yellow color, which changes to red or purple when alkalies are added; methylene blue produces a blue color, etc. The odor is recognized as normal aromatic, as ammonical or as putrid; the reaction is obtained with sensitive litmus paper. The specific gravity is readily determined by the urinometer, the specific gravity bottle, or by the specific gravity beads. If it is above 1.025, sugar in appreciable quantities may be expected. The instruments used for this work are usually corrected to conform to a temperature of 60° F (15° C.). If the temperature is above or below this standard 1° of the urinometer has to be respectively added or subtracted for every 5° F. (2.8° C.).

Tests for Albumin.

Serum albumin is the most often tested for of any constituent of the urine, and of the many tests which have been proposed the following are to be preferred. No single test is sufficient.

1. *Heat Test.*—Boil the urine in a test-tube; when an opalescence appears it indicates the presence of albumin

or an excess of phosphate. If a few drops of nitric acid are now added the cloudiness will disappear if due to phosphate, but will remain permanently if due to albumin.

2. *Purdy's Modified Heat Test.*—Fill the test-tube three-quarters full with urine and add saturated sodium chloride solution to fill the tube; now add 2 or 3 drops of strong acetic acid and, holding the tube in the fingers by its bottom, heat the upper layer of the fluid until the mixture boils; then, without shaking the tube or its contents, examine the layer of fluid in the upper part of the tube, comparing its degree of transparency with that of the fluid that was not heated in the lower part of the tube. If the heated portion of the fluid is in the slightest degree hazy or less transparent, albumin is present.

3. *Heller's Nitric Acid Test.*—A test-tube is filled to the depth of one-half inch with nitric acid, and while being held in an inclined position, the clear (filtered, if necessary) acid is allowed to trickle slowly down the inside surface from a medicine dropper, so as to form a superimposed layer on the acid. An opalescent ring at the junction of the two liquids indicates albumin. Excess of urates, mucus, etc., sometimes gives rings resembling those of albumin, but on close observation these rings will be seen to be slightly above in the column of urine instead of at the bottom of contact.

Tests for Sugar.

Sugar occurs less frequently in the urine than albumin, and is usually present in urine having a very high specific gravity—above 1.025. If a sample of the urine contains albumin, it should always be removed by boiling and filtering before any of the tests for sugar are applied.

1. *Fehling's Copper Test.*—Equal volumes of the ordinary Fehling's solutions are mixed in a test-tube and heated to the boiling point; if no reduction occurs, the solution may be considered safe, and the urine is now added drop by drop to the boiling Fehling's solution until an orange color or reddish precipitate forms, or until a volume of urine equal to that of the copper solution has been added. If there is no precipitate of orange or reddish cuprous oxide, sugar may

be considered absent. Simple discharging of the color of the formation of various bluish-gray precipitates must not be mistaken for a true reduction.

2. *Trommer's Modified Copper Test.*—Place one inch of urine in a test-tube and add one-half inch of potassium hydroxide solution, U. S. P., to the urine. Mix the two fluids by shaking the tube and add 2 or 3 drops of a 5 per cent solution of copper sulphate in distilled water. Do not heat the mixture, but allow the tube to stand undisturbed for twelve to twenty-four hours in the cold. At the expiration of that time, if sugar be present, there will be collected in the tube an ochre-yellow to brick-red precipitate of fine sand-like character of suboxide of copper.

Quantitative Estimation of Sugar.

The quantity of sugar in urine is very conveniently and quickly estimated by using "soloid"[1] tablets of copper sulphate and alkaline tartrate. It is based on Fehling's reduction test as follows:

Prepare a standard test solution by dissolving four "soloids" copper sulphate in about 2 cc of distilled water and in this solution also dissolve 4 "soloids" alkaline tartrate, then adjust to 4 cc at 15° C. Each cubic centimeter corresponds to 0.005 gram of anhydrous glucose. It may be found more convenient to dilute the above measure of 4 cc with an equal volume of water, when each cubic centimeter of diluted test solution will correspond to 0.0025 gm. of anhydrous glucose. Make a rough estimation by adding the urine to a definite volume of the boiling test solution in such quantity that, after boiling and allowing the precipitate to subside, the blue color of the reagent is just discharged. Now dilute the urine (if necessary) until it contains 0.5 to 1 per cent of sugar and make an accurate estimation with the diluted urine.

Tests for Uric Acid.

The presence of an excess of uric acid or of urates is usually readily detected by the physical appearance of the urine itself. If the urine has stood in a vessel from three to four hours and a sediment of red sand ("brick dust deposit") is seen in the bottom of the vessel, it usually points to an excessive excretion of urates. The urates are more soluble in hot water than in cold water and consequently the urine may be clear on voiding, but after becoming cold may deposit quite a sediment. The amorphous urates readily dissolve on warming. Under the microscope uric acid appears as whetstone-shaped crystals, which are sometimes arranged in rosettes. These crystals are usually of a yellowish-red color.

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[1] "Soloid" tablets are made by Burroughs Wellcome & Co., of London and New York.

1. *Hopkin's Test.*—To 100 cc of urine add 33 gm. of ammonium chloride. Shake or stir until it dissolves and then allow to stand in a cool place for three or four hours. Collect the precipitated ammonium urate on a filter and wash with saturated ammonium chloride solution until the filtrate is clean. Spread out the filter on a square glass plate and wash the precipitate down over one corner of the plate and into a beaker or flask with hot water. The contents of the beaker are now heated to boiling with an excess (10 cc) of hydrochloric acid and allowed to stand in a cool place for several hours (not less than three), when the uric acid will crystallize out. This is collected on a small filter (the volume of the filtrate being noted) and washed slightly with cold water. Wash off the filter into a flask with hot water, enough sodium carbonate solution being added to dissolve the uric acid, the volume is made up to 100 cc with water, 20 cc of sulphuric acid are added and a decinormal potassium permanganate solution run in from a burette until a faint pink coloration remains one minute after shaking. Each cubic centimeter of decinormal permanganate equals 0.007 gm. of uric acid, to which must be added 0.001 gm. for each 15 cc of the filtrate before noted.

2. *Murexid Test.*—Evaporate to dryness at a low heat over an alcohol lamp a few drops of urine in a watch crystal, add a drop or two of nitric acid and again cautiously evaporate to dryness. A red residue will remain. Now add a drop or two of ammonia solution without at first letting it come directly in contact with the residue. The formation

of murexid, which is shown by a beautiful purple color (purpurate of ammonia), indicates uric acid or urates.

Test for Indican.

Salkowski's Test.—Eight cubic centimeters of urine with 1 cc of a 10 per cent copper sulphate solution are mixed with an equal volume of hydrochloric acid of a specific gravity of 1.19. A few cubic centimeters of chloroform are added and the mixture inverted a number of times. The indican (indol-potassium sulphate) having been split up, the chloroform extracts the resulting indigo and takes on the characteristic blue color. The quantity is estimated by the depth of the blue color.

If the urine contains albumin, it must be removed before applying this test; otherwise the blue color often arising from the admixture of hydrochloride acid after standing may prove misleading. (Purdy.)

Test for Urobilin.

Strauss' Test.—The urine is acidulated with acetic acid and cleared by the addition of one-fourth of its volume of 10 per cent lead acetate solution and filtrate. The filtrate is then shaken with amyl alcohol, the urobilin being thus extracted, as is shown by the yellow to deep orange color. The addition of ammonious zinc chloride causes a fluorescence. Urobilin in very small quantities is present in the healthy urine.

SALIVA ANALYSIS.

(After Dr. Henry C. Ferris.)

History of chronic diseases.

Description of teeth and character of caries.

Amount of saliva. Normal average, 60 cc per hour; 20 cc required for examination.

Consistence: Report sticky, thick or thin.

Odor: Ammoniacal, sweet, sour, etc.

Specific gravity: Normal 1.002.

Precipitate: Centrifuge entire amount and record in terms of centrifuge scale. Then take 5 cc of this and dilute with an equal quantity of distilled water, which will become cloudy if globulin is present. Centrifuge again and record amount of globulin. Pour off supernatant fluid again in the centrifuge tube; add four drops of glacial acetic acid, which precipitates the mucin. Pour off supernatant fluid and add 1 cc of 10 per cent solution potassium ferrocyanide; if albumin be present specimen will become cloudy. Centrifuge as before and record quantity of albumin.

Enzymic action: Take immediately upon delivery. Make 2 per cent solution of starch paste, according to the following directions:

Mix starch with half the quantity of cold water and let stand for five minutes; then add the rest of the water and boil for ten minutes. Take 5 cc of this solution in test-tube and place in incubator at temperature of 55° C., to which add $\frac{1}{2}$ cc saliva, let stand for one minute and boil to kill action of enzyme. Centrifuge and read scale, which will give percentage of reduction of starch to dextrin. To determine further the product of the reaction, take 2 cc of the clear solution and add 1 cc of iodine solution N/250. If starch is present the reaction will be deep violet (iodide of starch); if a light violet, it indicates a partial reduction of starch, or erythrodextrin; a colorless result indicates complete reduction of starch to dextrin.

Proteolytic test:

1 cc Fehling copper solution.
5 cc Fehling alkaline.
94 cc $\frac{N}{10}$ sodium carbonate solution.

Dissolve in the solution 1 decigram casein C. P.

Take 5 cc of the above and place in the incubator at temperature of 50° to 55° C.; then add $\frac{1}{2}$ cc saliva, if there is a strong proteolytic action in a few seconds, the color turns to pink; if it is of medium action to violet; if no action, to a dirty blue color. The first represents peptones; second, albuminose; third, unsplit casein.

Oxydase Test.

Take 1 cc saliva, 4 cc distilled water, 12 drops of a 10 per cent solution of sulphuric acid, then mix and add drop by drop 0.5 per cent aqueous solution of metaphenylenediamin. If there is no oxydase, it stays without color. If there is an oxydase, there is formed triaminphenylin, which makes the solution strongly yellow.

Test for Acid Index.

Should be ascertained as soon as specimen is delivered. Use 1/40 normal sodium hydrate solution in 5 cc buret. The degree of acidity is obtained by taking 5 cc of saliva and adding 2 drops of phenolphthalein solution, neutral, then drop by drop 1/40 normal solution sodium hydrate until a rose color is produced. Having noted on paper the number of cc of the sodium hydrate solution in the buret before and after the rose color is obtained, the number of cc displaced multiplied by 20 and divided by 4 (in order to find the number of cc sodium hydrate solution necessary to reduce 100 cc saliva) equal the degree of acidity. Normal being alkaline.

To attain a more accurate result add 1 cc of 1/10 normal hydrochloric acid solution and boil to drive off the carbonic acid; titrate as before and subtract the acid index of the hydrochloric acid from result.

Test for Alkalinity.

Proceed as above, substituting 1/40 normal hydrochloric acid for sodium hydrate and methyl orange for phenolphthalein and titrate.

Ammonia or Organic Matter.

Take 2½ cc saliva and 1 drop phenolphthalein solution and titrate it with $\frac{N}{40}$ sodium hydrate solution to a feeble pink color. The used cc of the sodium hydrate solution gives the acidity in relation to phenolphthalein. Take formalin and put in 1 drop phenolphthalein solution and titrate it with NaOH solution to a feeble pink color.

Now both solutions are neutral or feebly alkaline to phenolphthalein; but if you put 1 cc of this neutralized formalin to the neutralized saliva the pink color disappears, because the ammonia is used up by the formalin. Now titrate a second time with $\frac{N}{40}$ sodium hydrate until the reappearance of the pink color. This amount corresponds to the amount of ammonia. Multiply the cc by 0.017 and you have the percentage of ammonia in the saliva. Proof: $2\frac{1}{2}$ cc and $\frac{N}{40}$ has the same relation as 100: $\frac{N}{1}$; therefore, the amount of grams in the amount of cc normal solution (instead of used $\frac{N}{40}$ sodium hydrate solution) gives the percentage. Ammonia has the atomic weight of 17, therefore 1 cc normal solution corresponds to 0.017 per cent and any amount of cc used must be multiplied by 0.017 per cent.

Sulfocyanate Test.

Use colorimetric scale (Eimer & Amend), 1 cc of specimen in tube A, 1 cc of 1:2000 ammonia sulfocyanate in tube B; add 2 drops of 5 per cent ferric chloride to each tube, add distilled water until color in B matches that of specimen. Read scale in thousandths and ten thousandths. Care must be taken to have the bottom of the meniscus on the line.

Chlorine.

To 1 cc of specimen add 2 or 3 drops of potassium bichromate 1 per cent solution; then titrate with $\frac{N}{10}$ silver nitrate solution until a light brick-red color is attained. Multiply the buret cc used by 0.3545. The result will show the amount of chlorine.

Urea.

To attain the amount of urea, use a Ferris' modified Doremus ureometer, supplied by Eimer & Amend, New York. Tube A is washed with water and filled with hypobromite solution; close the stopper and fill tube B with 1 cc of specimen; open the stopper, allow specimen to enter tube A and close stopper. After all bubbles of gas have disappeared, the reading is taken. The degrees marked upon the tube are divided into 0.025 and represent the number of grams or grains of urea contained in the amount of saliva employed. (The normal relation between the chlorine and the urea in the urine is 1:2).

Acetone.

In 4 drops of specimen dissolve a crystal of potassium carbonate, then add a drop of Gram's reagent. An odor of iodoform indicates acetone. (Care must be taken not to confound the odor of iodine in Gram's reagent with that of iodoform.) To mount slide and examine with microscope for crystals of iodoform is best test.

Total Solids and Ash.

To obtain total solids cleanse and weigh a platinum dish, into which place 2 cc of specimen. Dry in the incubator at 100° C. from two to three hours. Care should be taken that it does not turn too black. Weigh again and add to this 2 or 3 drops of fuming nitric acid. Evaporate the acid and burn it white. Weigh again. The first gives the total of solids and the second the amount of ash.

Note A.—To determine the percentage of chlorine in total solids, you multiply the chlorine by 110 and divide by total solids.

Note B.—In urine the normal amount of chlorine is 15 per cent of total solids and it is reduced in pathological states.

DIAGNOSTIC HINTS.

Frequency of Pulse.

At birth	130–150	times a	minute
At the first year . . .	100–130	“	“
At the seventh year . .	72– 90	“	“
At the time of puberty .	80– 85	“	“
At middle life	69– 75	“	“
At old age	50– 60	“	“

Frequency of Respiration.

At the first year	35	times a	minute
At the second year . . .	25	“	“
During time of puberty . .	20	“	“
Above twenty years of age .	18	“	“

Temperature of the Body.

Normal temperature	97½– 98½° F.
Feverishness	99 –100° F.
Slight fever	100 –101° F.
Moderate fever	102 –103° F.
High fever	104 –105° F.
Intense fever	105 F.

Comparison Between Temperature and Pulse.

A	temperature	of	98° F.	corresponds	to a	pulse of	60
"	"	"	99° F.	"	"	"	70
"	"	"	100° F.	"	"	"	80
"	"	"	101° F.	"	"	"	90
"	"	"	102° F.	"	"	"	100
"	"	"	103° F.	"	"	"	110
"	"	"	104° F.	"	"	"	120
"	"	"	105° F.	"	"	"	130
"	"	"	106° F.	"	"	"	140

CHAPTER IX.

MISCELLANEOUS.[1]

REMEDIES FOR THE TEETH.

Toothache Gum.

Beeswax	16 parts
Lard	4 “
Oil of clove	8 “
Creosote	8 “

Melt the wax and lard, when cool add the oil of clove and the creosote and sufficient cross-cut cotton to saturate it thoroughly with the mixture. Roll into small sticks, wrap in paraffin paper and place in vials.

Toothache Drops.

Chloral hydrate	1 part
Menthol	1 “
Gum camphor	2 parts
Eugenol	2 “

Rub together until a syrupy liquid is obtained.

Toothache Sticks.

Beeswax	8 parts
Phenol	6 “
Eugenol	1 part

Melt the wax and add the phenol and the eugenol. While still liquid immerse thin layers of absorbent cotton in the fluid and when sufficiently cool roll them into the shape of rods. For use snip off a little piece, warm it gently and introduce into the cavity of the tooth.

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[1] Under this heading pharmaceutical and technical formulas and preparations are enumerated, which may be more or less useful. They actually represent in part many of the inquiries which were received by the author from dental practitioners.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Toothache Cement.

Gum copal	10 parts
Gum mastic	20 "
Chloroform	50 "
Tannic acid	5 "
Oil of clove	5 "

Dissolve the gum mastic and copal in the chloroform and add the other ingredients. Apply on a ball of cotton.

Tooth Polish for the Removal of Stains.

Acid potassium tartrate	1 part
Pumice stone	1 "

Mouth Cachou.

Orris root	250 parts
Musc	$\frac{1}{4}$ part
Cumarin	1 "
Vanillin	5 parts
Oil of rose	5 "
Oil of orange, sweet	5 "
Oil of peppermint	5 "
Oil of spearmint	5 "
Oil of ylang-ylang	2 "

Extract of licorice, enough to make a solid mass.

Divide into pluglets of about one grain each.

REMEDIES FOR THE HAIR AND SCALP.

Hair Tonic for Oily Hair.

Resorcinol	1 part
Compound tincture of cinchona	4 parts
Bay rum, enough to make	64 "

Apply to scalp twice a day.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Hair Tonic for Dry Hair.

Betanaphthol	½ part
Balsam of Peru	5 parts
Castor oil	10 "
Alcohol	100 "
Oil of bergamot	1½ "

Apply to scalp twice a day.

Alopecia Ointment.

Pilocarpine hydrochloride	3 parts
Lanolin	350 "
Cold cream, enough to make	1000 "

Apply to scalp daily.

Shampoo Powders.

1.

Powdered quillaja	12 parts
Camphor	1 part
Borax	50 parts
Sodium carbonate, dried	25 "
Oil of rosemary	2 "

2.

Powdered soap	16 parts
Dried sodium carbonate	8 "
Borax	4 "
Oil of rosemary	1 part

Brilliantine.

Castile soap, powder	2 parts
Tincture of benzoin	10 "
Castor oil	20 "
Alcohol	180 "
Oil of bergamot	½ part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Eau de Quinine.

Quinine hydrochloride	4 parts
Tannic acid	10 “
Alcohol	850 “
Tincture of cantharides	10 “
Glycerin	60 “
Eau de Cologne	40 “
Vanillin	$\frac{1}{10}$ part
Red saunders wood	$\frac{1}{2}$ “

Filter after a week's standing.

Bay Rum.

Oil of allspice	1 part
Oil of orange	1 “
Oil of Bay	5 parts
West Indian Rum (Santa Cruz)	200 “
Alcohol	400 “
Water	400 “
Talc	20 “

Dissolve the oils in the alcohol, add the rum and finally the water and the talc. Allow the mixture to stand, with occasional agitation, during five to six days and then filter, returning the first portions of the filtrate until it passes through clear.

Depilatory Compound.

Barium sulphide, fresh	2 parts
Zinc oxide	3 “
Corn starch	3 “

Mix with water into a paste, spread on the hairy parts with a wooden spatula, and when dry, wash off with warm water.

Depilatory Pencil.

Vermilion	1 part
Yellow beeswax	8 parts
Rosin	16 “

Melt on a water-bath, stir well and pour in suitable moulds.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Hair Dyes.

1.

Solution A.

Silver nitrate	2 parts
Distilled water	15 “

Keep in amber-colored bottle.

Solution B.

Copper sulphate, C. P.	$\frac{3}{5}$ part
Distilled water	10 parts
Ammonia water	6 “

Add equal parts of solution A to B when needed. Apply with a soft toothbrush, comb the hair thoroughly and expose to sunlight for ten minutes.

2.

Solution A.

Silver nitrate	10 parts
Distilled water	240 “
Ammonia water	5 “

Solution B.

Pyrogallic acid	4 parts
Tannic acid	2 “
Acetic acid, diluted	8 “
Distilled water	240 “

Mix equal parts of solutions A and B when needed and apply as above. If black stains about the skin should result from accidental contact with the dye, they may be removed with the following solution.

Potassium iodide	2 parts
Distilled water	16 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

REMEDIES FOR THE SKIN AND THE HANDS.

Hand Cream.

Lanolin	25 parts
Glycerin	35 “
Borax	5 “
Oil of geranium	1 part

Greaseless Toilet Cream.

Gum tragacanth	2 parts
Water	125 “
Glycerin	8 “
Tincture of benzoin	2 “
Borax	2 “

White rose extract, enough to perfume.

Macerate the tragacanth in the water until it is perfectly soft. Dissolve the borax in the glycerin. Mix the two solutions, add the tincture and the perfume and press through muslin.

Massage Creams.

Stearic acid	3 parts
Cocoa butter	½ part
Sodium carbonate, pure	2 parts
Borax, powdered	½ part
Glycerin	2½ parts
Water	40 “
Mucilage of tragacanth	10 “
Alcohol	3 “

Perfume, enough to suit.

Dissolve the borax and sodium carbonate in the water and add this solution, with the glycerin and mucilage to the cocoa butter and stearic acid contained in a vessel on a water-bath. Heat the whole together until effervescence ceases, allow to cool, then add the perfume dissolved in the alcohol and beat until the mass stiffens. Heat again and beat until it becomes creamy and fluffy.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Hand Lotion.

Gum tragacanth, in fine powder	¼ part
Boric acid	1 “
Glycerin	5 parts
Water	32 “

Perfume, enough to suit.

Skin Food.

White wax	4 parts
Spermaceti	4 “
Cocoanut oil	8 “
Lanolin	8 “
Oil of sweet almonds	16 “

Melt together in a porcelain capsule, remove from fire and add:

Orange flower water	8 parts
Tincture of benzoin	¼ part

Briskly beat until a perfect cream is obtained.

Skin Lotion.

Borax	16 parts
Potassium carbonate	2 “

Dissolve in hot water and add:

Glycerin	16 parts
Eau de Cologne	16 “
Tincture of benzoin	4 “
Essence of violet	4 “
Rose water, enough to make	125 “

A teaspoonful to be added to a basin of warm water.

Almond Meal Compound.

Almond meal	25 parts
Orris root, powdered	5 “
Borax	3 “
Castile soap powder	2 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Fingernail Bleach.

Sodium perborate	2 parts
Cornstarch	2 “

Make into a paste with water and apply to the nails. After drying wash off with warm water and polish with putty powder.

Nail Polish.

Precipitated chalk	50 parts
Putty powder	150 “
Carmine	1 part
Perfume	to suit

Hand-Cleaning Pastes.

1.

Extract of quillaja	2 parts
Borax	1 part
Fuller’s earth	1 “
Soft soap	1 “
Perfume	q. s.

Triturate the borax with the extract of quillaja and afterward with Fuller’s earth; then incorporate with the soft soap and sufficient water to form a paste. Lastly perfume as desired.

2.

Domestic soap, dried and rasped	750 parts
Sodium carbonate, crystallized	20 “
Hot water	120 “

Heat upon the water-bath until soft; thoroughly mix. Then add:

Pulverized pumice stone	200 parts
Pulverized talc	50 “
Perfume, enough	to suit

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Shaving Cream for Collapsible Tubes.

Curd soap	8 parts
Spermaceti	$\frac{1}{2}$ part
Oil of almonds	2 parts
Glycerin	1 part
Potassium carbonate	$\frac{1}{4}$ “
Water	16 parts

Cut the soap into shreds and dissolve on a water-bath in 14 parts of water. Dissolve the spermaceti in the almond oil and while warm mix it with the glycerin, potassium carbonate and remainder of the water. Transfer to a warm mortar, gradually incorporate the warm soap solution and continue to stir until a smooth paste is obtained. Incorporate any suitable perfume.

For Barber's Itch.

Tannic acid	2 parts
Gum camphor	2 “
Alcohol	10 “
Ether	10 “

Soap Powder Cleansers.

1.—Borax Soap Powder.

Soap	5 parts
Sodium hydroxide	3 “
Sodium silicate	2 “
Sodium borate	1 part

2.

Soap	6 parts
Sodium hydroxide	2 “
Pearlash	1 part
Sodium sulphate	1 “

3.—Dry Soap Powder.

Desiccated hard soap	28 parts
Sodium carbonate (crystals)	68 “
Anhydrous boric acid	1 part
Boron nitride	1 “
Ammonium chloride	1 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid Soap.

Sodium hydrate	32 parts
Potassium hydrate	200 "
Cotton-seed oil	400 "
Alcohol	200 "
Distilled water	2000 "

In a suitable container, preferably a glass-stoppered bottle, dissolve the sodium hydrate and the potassium hydrate in 250 parts of distilled water, add the alcohol, and then add the cotton-seed oil in 3 or 4 portions, shaking vigorously after each addition. Continue to agitate the mixture occasionally until saponification has been completed; then add the remaining portion of distilled water and mix. The only precautions that are at all necessary is to use U. S. P. grade of ingredients, and to be sure that saponification is complete before adding the remaining portion of the distilled water.

Hand Cleansers for Motorists.

Soft soap	16 parts
Ammonia water	1 part
Finely levigated pumice stone	6 parts
Oil of turpentine	2 "

Eau de Cologne.

Oil of bergamot	8 parts
Oil of lemon	4 "
Oil of rosemary	4 "
Oil of neroli	2½ "
Oil of lavender	2 "
Oil of sweet orange peel	½ part
Acetic ether	½ "
Acetic acid, diluted	½ "
Alcohol	850 parts
Orange flower water, enough to make	1000 "

Mix and age at least a month before filtering.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Lavender Water.

Oil of lavender, English	3 parts
Oil of bergamot	1 part
Tincture of ambergris	1 "
Alcohol	70 parts
Water	30 "

Mix and age at least a month before filtering.

English Smelling Salt.

Ammonium carbonate	80 parts
Ammonium chloride	20 "
Oil of lavender	4 "
Oil of lemon	2 "
Oil of bergamot	1 "
Alcohol	4 "
Glycerin	4 "

The salts are coarsely powdered and perfumed with the alcoholic solution of the oils; lastly add the glycerin. Keep in a well-stoppered bottle.

SOLID ALCOHOL.

Heat 1000 parts of denatured alcohol (90 per cent) in a flask of double the capacity on the water-bath to about 140° F., and then mix with 28 to 30 parts of well-dried rasped Castile soap and 2 parts of gum lac. After repeated shaking, complete dissolution will take place. The solution is put, while still warm, into metallic vessels, closing them up at once and allowing the mixture to cool therein. The admixture of gum lac effects a better preservation and also prevents the evaporation of the alcohol. On lighting the solid spirit the soap remains behind.

DUSTING POWDERS FOR SORE FEET.

1.

Salicylic acid	1 part
Boric acid	2 parts
Zinc oxide	2 "
Talc	10 "

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2.

Zinc stearate	2 parts
Boric acid	4 “
Talc	16 “

LIQUID CORN REMEDY.

Salicylic acid	12 parts
Extract Indian hemp	2 “
Alcohol	10 “
Flexible collodion, enough to make	100 “

LIQUID WART REMEDY.

Trichloracetic acid	5 parts
Diluted alcohol	5 “

TREATMENT FOR BURNS AND SCALDS.

Exclude air by thin paste of starch, flour, or baking soda. Ordinary oils such as vaseline, olive or castor oil, lard or cream may also be used. Lime water mixed with an equal part of raw linseed oil makes an excellent dressing. An especially valuable material for all burns is picric acid gauze which may be applied in the form of a compress.

After treatment with any of the above materials, cover with a cloth or with cotton and hold in place with a light bandage.

CARRON OIL FOR BURNS.

Raw linseed oil	50 parts
Lime water	50 “
Cresol	1 part

Shake well before using.

ACID AND ALKALI BURNS.

With either, wash off as quickly as possible with a large quantity of water. Water from a tap may be allowed to flow over burns.

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Acids.

While the injury is being washed, have procured, lime water or lime water and raw linseed mixed together in equal proportions or a mixture of baking soda and water or soap suds and apply freely. For acid in the eye wash as quickly as possible with water and then with lime water.

Alkalis.

Wash with a large quantity of water as for acid burns. Neutralize with weak vinegar, hard cider or lemon juice. For lime or other strong alkali burns in the eye wash with a weak solution of vinegar or with olive oil or a saturated solution of boric acid.

LUBRICANT FOR SYRINGE PISTONS, SOUNDS, ETC.

Irish moss	1 part
Gelatin	1 “
Phenol solution, 2 per cent	32 parts

Macerate the first two ingredients in the phenol solution over night. Then heat the mixture, and while warm strain by squeezing through gauze.

LUBRICANT FOR SURGEON'S RUBBER GLOVES.

Gum tragacanth	8 parts
Boric acid	4 “
Solution of formaldehyde	1 part
Alcohol	32 parts
Water	200 “

Oil of rose geranium, enough to suit.

Dissolve the gum tragacanth in the water, in which the boric acid has previously been dissolved. Dissolve the oil in the alcohol, add the solution of formaldehyde and mix with the gum solution. Keep in well-stoppered wide-mouthed bottles.

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A SUBSTITUTE FOR RUBBER GLOVES.

1.

Celloidin	1 part
Alcohol, 96 per cent	5 parts
Castor oil	¼ part

The hands are thoroughly cleansed with soap and hot water, dried, washed in alcohol and again dried. The above solution is now painted on the hands. It leaves an elastic coat. Washing in alcohol will remove it.

2.

Pyroxylin (soluble cotton)	1¾ parts
Amyl acetate	35 “
Canada turpentine	12 “
Castor oil	3 “
Cresol	1 part
Acetone	100 parts

Mix and agitate until dissolved.

To remove this varnish from the hands a solvent consisting of equal volumes of acetone and denatured alcohol may be used.

LIQUID SPLINT FOR THE FIXATION OF FRACTURES.

Powdered starch	2 parts
Gelatin	2 “
Solution of potassium silicate	60 “
Boric acid	1 part

Mix the starch with the solution of silicate of potash by shaking from a pepper-box and stirring constantly until mixed. Dissolve the gelatin in 10 parts of warm water and add the solution to the mixture. Put into a jug of double the capacity and ferment at room or sun temperature for three or four days. Then add the boric acid, mix well, and it is ready for use.

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If too thick after standing, thin it with boiling water. Keep corked. Apply a silk stocking or roller bandage then a coat of the preparation with a brush, and repeat until three or four layers are applied or until the splint is thick enough. It may be cut after hardening and eyelets and laces put in.

TO MAKE A PLASTER CAST FROM LIFE.

The face is well covered with vaseline, the eyelashes and eyebrows are well buried in wet clay (antiphlogistine is serviceable) and well covered with wet tissue paper and smaller hairs smoothened down. Mustache, whiskers, etc., are coated with clay and oiled. Rubber tubing or quills are inserted into the nostrils for respiration. If the ear is embedded, stop it up with cotton and wax. Have the patient in a recumbent position and apply the well-mixed plaster with a spatula. Just before setting bury a stout string into the plaster corresponding to the long axis of the face. When hardened, cut the plaster by pulling the string, which facilitates the ready removal of the impression. The impression must be thoroughly set before the cast is made. Soak the impression in water and paint it with a separating medium. The cast has to set for at least two hours before separation is undertaken.

PLASTIC COMPOUNDS FOR THE RESTORATION OF FACIAL DEFECTS.

1.

Carpenter's glue	9½ parts
Best molasses	4½ "
Glycerin	7 "

Soak the glue in water over night, pour off the excess and add the molasses and the glycerin. Melt on a water-bath under constant stirring.

2.—Pont.

Gelatin, white	20 parts
Carpenter's glue, white	5 "
Water	25 "
Glycerin	62 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Cut the gelatin and glue into small pieces, add the water and cover the vessel to prevent evaporation. Let stand over night. Now add the glycerin and heat on the water-bath, under constant stirring, until complete solution is obtained.

To impart to the compound a natural flesh-tint is quite a difficult procedure and requires artistic skill. The most suitable color compounds are those known as artist's water colors in tubes. The following list is serviceable for the purpose: Terra di Sienna, burnt Terra di Sienna, carmine, ultramarine, light or French ochre, ivory black and zinc oxide.

According to Zinsser convenient emulsions of these colors for tinting the compound may be prepared by emptying the contents of the tubes into 1 ounce bottles and adding an equal amount of glycerin. Shake thoroughly before using. The average quantity of compound required for a nose necessitates from 20 to 30 drops of the zinc oxide emulsion, from 2 to 5 drops of the carmine emulsion, and very little of the ochre or Terra di Sienna. These emulsions are added to the melted compound and are thoroughly mixed with it by stirring with a glass rod. A few preliminary trials are necessary to obtain a close approximation of the facial color of the patient.

The wax nose is carefully modelled over the plaster cast obtained from the facial impression. The wax nose thus obtained is taken from the model and on one side a thick layer of plaster is poured. The plaster is cut and shaped before it hardens, so as to give it as geometrical a shape as possible. It is coated with oil and a counter-die of plaster is poured so as to completely envelop the wax nose. One thus obtains a cast in two parts. It is sometimes necessary to make a cast in three parts. It only remains to take out the wax and pour the liquefied plastic compound, melted on a water-bath, into the mould through a vent-hole shaped like a funnel. As the compound slightly contracts on cooling, a surplus of material must be allowed. Only sufficient heat should be applied to melt the compound. Do not overheat

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it. The mould must be dusted with talc so as to prevent the plaster from sticking to the compound. Leave it to harden in a cool place for an hour, then separate the parts of the cast and take out the artificial nose. The surplus of the compound is cut away with scissors so as to leave the edges quite clean. It only then remains to fasten the prosthetic appliance in position with a suitable adhesive.

The following varnish answers this purpose admirably well:

Gum mastic	30 parts
Canada balsam	5 "
Ether	30 "

Keep in a well-stoppered bottle.

One coat of the varnish painted over the inside of the artificial substitute is quite sufficient; then put the appliance quickly on the skin. Level the edges with a warmed blunt instrument. It is useful to touch up slightly with a carmine pencil those parts which are naturally redder (as the interior of the nostrils, etc.) and to put on carefully a little face powder. The patient quickly learns not only to do this easily—but also to make his own nose.

PRESERVING FLUID FOR ANATOMICAL SPECIMENS; KAISERLING.

For preservation of colors of gross pathological specimens the following method gives satisfactory results:

1. Fix the tissue for one to five days in Kaiserling's Fluid No. 1:

Formaldehyde	200 parts
Water	1000 "
Potassium nitrate	15 "
Potassium acetate	30 "

2. Drain and place in 80 per cent alcohol from one to six hours.

3. Ninety-five per cent alcohol for one to two hours.

4. Preserve specimen in Kaiserling's Fluid No. 3:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Potassium acetate	200 parts
Glycerin	40 “
Water	2000 “

For display purposes the preparations preserved by these methods are often mounted permanently in gelatine. A jelly is made as follows:

Finest French gelatin	40 parts
Water	210 “
Glycerin	250 “
Carbolic acid crystals	5 “

Soak the gelatine in the water for two hours. Add the glycerin and the carbolic acid and warm for ten to fifteen minutes, stirring all the while until the mixture is smooth. It is advised to filter through the finest spun glass laid wet in a funnel.

EMBALMING FLUID.

1.

Solution of formaldehyde	16 parts
Phenol, liquid	4 “
Water	60 “

2.

Boric acid	2 parts
Borax	5 “
Potassium nitrate	5 “
Glycerin	8 “
Solution of formaldehyde	22 “
Solution of eosin (1 per cent)	$\frac{4}{10}$ part
Water, to make	160 parts

Dissolve the boric acid, borax and niter in 75 parts of water, then add the glycerin, formaldehyde, eosin and balance of the water.

MÜLLER'S HARDENING FLUID.

Potassium bichromate	2 parts
Sodium sulphate	1 part
Distilled water	100 parts

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FLEMING FIXING FLUID.

Osmic acid solution, 1 per cent	80 parts
Chromic acid	1½ "
Glacial acetic acid	10 "
Distilled water	200 "

HARD RUBBER CORROSIONS OF THE PULP CANALS OF TEETH.

(After Dr. J. A. Brown.)

The preparation of vulcanite corrosions of the pulp canals of teeth consists of the following distinct steps:

1. Removal of the contents of the canals.
2. Washing out and drying of the canals.
3. Packing the canals with vulcanizable rubber.
4. Investing the tooth in plaster of Paris and vulcanizing.
5. Removal from the investment and corroding the tooth in an acid.

The process in detail is as follows: Making an opening into the pulp chamber of the tooth and with suitable broaches remove the contents of the canals. Wash and dry the tooth. Fill the canals with a solution of vulcanizable rubber in chloroform and keep in a warm place until the chloroform has entirely evaporated. Now pack some more rubber into the pulp chamber, force it in the canals as far as possible with warm instruments. Before investing the teeth press a small roll of rubber into the pulp chamber by means of a hot spatula. The purpose of the extra roll of rubber is to force more material in the canals by the expansion of the rubber during the process of vulcanization. The flask should be vulcanized for an hour and thirty minutes at a temperature of 320° F. When cold remove the tooth from the investment, wash in water and place in 50 per cent hydrochloric acid, which corrodes the tooth substances, leaving a hard rubber cast of the canals and pulp chamber complete.

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CLEANING AND BLEACHING OF BONES.

A skull in the flesh or one which, though dry, has been properly roughed out and dried will always make the best specimen. Roughing out, as the natural science collector would term it, is removing the skin and the major portion of the flesh from the skull. Care should be taken when working on the underside of the skull not to injure the often long and delicate styloid, hamular and other processes. With a flattened instrument, slightly bent at one end, remove all the brain substance possible. Place the roughed-out skull in a bucket of cold water, changing the water daily until it is no longer bloody. If it is not convenient to macerate the skull at this time take it from the water and place it in a shady place to dry. It can then be kept as long as desired and will have little or no odor. On the collecting grounds the skulls are treated in this way and can then be shipped to any point in safety.

Roughed-out ligamentary skeletons—the skeletons of all smaller animals, reptiles and birds are of this kind—are soaked in an aqueous solution of arsenic for fifteen minutes to protect them from the ravages of insects which would otherwise destroy the ligaments by which the bones are held together when mounted. Skulls, of course, do not need this treatment. Skulls should never be buried in the soil or boiled in water to remove the flesh, as either method tends to set the blood in the bones and leave them dark and discolored. Placing them in an anthill and allowing the ants to remove the flesh will produce the same effect. Skulls exposed for a long time to the weather become dark and can rarely be whitened.

Place the bucket containing the roughed-out specimens in a warm place and in summer, which is the best time to macerate, place in a sunny location, filling the bucket as the water evaporates. In winter a covered crock in a warm, sheltered nook will do, though the maceration process will be much slower. In Milan, Italy, where large numbers of skeletons are macerated yearly, pieces of horseflesh are

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thrown in the maceration tubs to hasten the decomposition. The time of maceration varies, being best in summer, slower in winter; fresh skulls in this climate in the summer requiring from six to eight weeks. When the skull has macerated sufficiently, remove it from the bucket and scrub it in clean water with a stiff brush until thoroughly cleansed. A scraper is often of great service in cleaning the skull cavity.

Now take two gallons of water, bring it to the boiling point and add first two pounds of washing soda and then one pound of chloride of lime. Then, with a brush, wash the skull in this solution, commonly called Javelle water. The washing soda assists in removing the grease from the skull, while the chloride of lime bleaches the bones by means of the chlorine liberated. The length of time the skull is washed in this solution will depend on the strength of the solution and quality of the bone; strong, hard bones are not easily affected, while a delicate bone, left long in the solution, ceases to exist in its original form.

After washing the skull in Javelle water the proper length of time, rinse thoroughly in clean water to remove any of the lime which may have been deposited and which, on drying, fills the small pits of the bone, giving it an unnatural, chalky appearance. Place the skull in the sunshine, when it soon becomes white. If, after two or three days, it is not as white as desired, again wash in Javelle water. If the skull shows signs of grease place it in a glass jar containing naphtha and allow it to remain in the sunshine, the jar to be covered with a glass plate to prevent the readily volatilized liquid from vaporizing. The skulls are placed in the sunshine as the warmth assists the action of the naphtha. The time needed to properly degrease skulls depends considerably on their size, the smaller ones being degreased more rapidly than a relatively larger skull. For small skeletons and skulls about two months would be the average length of time required.

After removing from the naphtha again wash the bones in the Javelle solution, rinse in water and again place in

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the sun to bleach. In many fresh skulls the bones show little or no signs of grease and do not need this treatment, and in large skulls and skeletons a special machine is needed, which, though doing the work quicker and using a much smaller amount of naphtha, is much more likely to injure the bones.

The bones from the dissecting room, if strongly injected, seldom bleach perfectly, just why one cannot tell, the arsenic with which the subjects are injected being, no doubt, the cause. Bones of this sort often remain in maceration for a year and a half and then are very hard to clean, while fresh specimens would be fully cleaned in one-fourth of that time.

In macerating skulls great care should be taken to prevent any brass or iron getting into the water, as the brass renders the bones of a greenish hue, which, as yet, nothing has been found that will remove. The iron rusts the bones and then they must be scrubbed in hot hydrochloric acid, washed in Javelle fluid, rinsed in clean water and bleached.

THE SPALTEHOLZ METHOD OF PREPARING TRANSPARENT ANATOMICAL SPECIMENS.

Fixing.—The fixing of the object may be readily accomplished by using a weak formaldehyde solution; the official formaldehyde solution contains about 37 per cent of the gas dissolved in water. A suitable solution is made by adding 10 parts of formaldehyde solution to 90 parts of water. The object remains in the solution several days.

Decalcifying.—As a decalcifying fluid, dilute hydrochloric acid is preferably employed. The process is started with a 2 per cent solution and followed by a 1 per cent solution until complete decalcification is accomplished. The acid should be used in quantities amounting to about forty to fifty times the volume of the object and it must be changed daily. The official hydrochloric acid contains 31.9 per cent by weight of absolute acid. A 2 per cent solution is prepared by adding

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20 parts of the pure acid to 219 parts of water. To test the progress of decalcification, a fine steel (sewing) needle is thrust into the bone at its thickest portion; if the needle readily passes through the bone, the process is completed. Too many punctures should be avoided.

Washing.—After complete decalcification, the specimen is washed in running water for a few hours and then remains immersed in water with frequent changes, for two or three days, or until the water reacts neutral to blue litmus paper.

Bleaching.—Occasionally it is advisable to bleach a specimen. The official hydrogen peroxide solution is satisfactorily employed for this purpose. It should be used undiluted and the specimen completely immersed in it for one to two hours. After bleaching, the specimen is again washed in running water.

Dehydrating.—The removal of water from the tissue cells is best accomplished by immersing the decalcified specimen successively in alcohol of various grades. The process is started by using a mixture of equal volumes of alcohol, 95 per cent, and distilled water. After twenty-four hours a mixture of 2 volumes of alcohol, 95 per cent, and 1 of water is used, which, after twelve hours, is replaced by 95 per cent alcohol. Finally, the alcohol is changed to absolute alcohol and the specimen remains in it for twenty-four hours. A small quantity of well-burned unslaked lime may be added to the absolute alcohol to take up traces of water. The alcohol incidentally hardens or "fixes" the soft gelatinous specimen.

Clearing.—Of the various clearing fluids, benzol or xylol act equally well. Both are hydrocarbons and are very inflammable. Benzol is the cheaper of the two. The clearing fluid has to be changed twice; the specimen remains in the first bath for twenty-four hours, or until complete penetration is accomplished. The fluid is then removed and the specimen is immersed in the second bath, charged with fresh benzol or xylol for two to three days. The clearing fluid may be preserved for future use, but only for

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the first clearing; the second clearing always requires fresh benzol or xylol.

Permanent Clearing and Preserving Fluid.—The final solution in which the specimen is permanently preserved is methyl salicylate, which is a hydrocarbon, whose index of refraction is equal, or nearly so, to that of the specimen.

The specimen is transferred from the clearing fluid to the methyl salicylate as quickly as possible to prevent the air from entering into its cellular structure. If air bubbles have formed in the specimen, they may be removed by exhausting the air with a suction pump.

It has been found that a very good quality of a light mineral oil, such as Nujol, for instance, makes an excellent permanent and inexpensive preserving fluid.

After the specimen is placed in the final fluid, the container is covered with a layer of cheese-cloth to allow the benzol or xylol to evaporate and to keep out the dust, etc.

Preserving Jars.—Specimen jars must be made of perfectly clear glass and have parallel sides. If possible, they should have a polished front. Round jars will distort the light rays and consequently disturb the image.

The perfect sealing of the lid to the jar has offered many difficulties as the ordinary sealing materials, which are more or less of a resinous character, will be dissolved by the preserving fluid. Fish glue, coated over the edges and rendered insoluble by precipitating with chromic acid, has been found very serviceable.

To insure success, it is imperative that the various steps of the process be carefully followed in rotation, and we, therefore, recapitulate them briefly.

1. Fixing of the dry or green specimen in a suitable solution.
2. Decalcifying.
3. Washing in running water.
4. Bleaching.
5. Second washing.
6. Dehydrating in graded alcohol.
7. Clearing in benzol or xylol.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

8. Permanent clearing in preserving fluid.
9. Evaporating the benzol or xylol and final sealing of the jar.

Green or dry bones may be used with equally satisfactory results. The bones must be thoroughly cleansed of adhering soft tissue and washed with soap, water and brush before they are subjected to the treatment. In decalcifying a jaw with the teeth in position, the enamel of the teeth is naturally totally destroyed, while the organic matrix of the teeth and the bone remain intact.

If it is intended to preserve the enamel of the teeth the crowns should be carefully coated with wax or paraffin before the preparation is subjected to the acid. Of course the remaining enamel cannot be made transparent.

The pulps do not have to be removed from the teeth; they will be made perfectly transparent by the process.

If it is desirous to show the relation of the various canals in the specimen, we first inject with a colored gelatin solution, *i. e.*, prior to decalcification. The gelatin is prepared by taking a sufficient quantity of the best quality French gelatin (Silver Label), and placing it in distilled water for twelve hours or until it is saturated. It is then pressed out by hand and melted in a porcelain dish on a water-bath. For coloring, vermilion, *i. e.*, artificial cinnabar, is used in the proportions of 5 parts of vermilion to 25 parts of gelatin. The freshly prepared mixture has to be injected under pressure while hot. For this purpose we use a glass or hard rubber syringe heated to the proper degree. Insert the nozzle of the syringe in the mandibular foramen, the nozzle is wrapped in wet cotton to assist in making a water-tight joint. As soon as the colored solution appears about the mental foramen, the opening is closed with the finger and the injection is continued. The alveoli from which the teeth have been removed are plugged with wet cotton. Superfluous material pressed out may be trimmed away, when set, with a sharp knife.

The gelatin is now rendered insoluble by immersion in a

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weak formaldehyde solution for a suitable length of time, *i. e.*, about five hours.

WRITING FLUIDS AND ACCESSORIES.

Standard Blue-black Ink.

Pure dry tannic acid	25 parts
Gallic acid, in crystals	8 "
Ferrous sulphate	30 "
Dilute hydrochloric acid (U. S. P.)	25 "
Phenol, liquid	1 part
Bavarian-blue dye (Schultz and Julius No. 478)	2 parts
Distilled water to make	1000 "

Dissolve the tannic and gallic acids together in about 50 parts of warm water and allow to cool; dissolve the ferrous sulphate in about 150 parts cold water. Add the hydrochloric acid to the ferrous sulphate and immediately mix the solutions. Add the dye dissolved in water and the liquid phenol and make up with distilled water to 1000 parts. Mix thoroughly.

Indelible Ink.

Extract of logwood	20 parts
Boiling water	280 "

After solution has been effected mix with a liquid composed of:

Potassium bichromate	3½ parts
Hot water	20 "
Hydrochloric acid	8 "

Ink for Marking Linen.

A.

Silver nitrate	5 parts
Ammonia water	10 "

B.

Sodium carbonate	7 parts
Gum arabic	5 "
Distilled water	12 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Add solution A to B and keep in well-corked bottles, protected from light. Mark linen with a new steel or quill pen and apply a hot flatiron.

Indelible Ink for use with a Hand-stamp.

Silver nitrate	12 parts
Sodium carbonate	24 “
Ammonia water	20 “
Venice turpentine	10 “
Gum arabic, powdered	20 “

Glycerin, a sufficient quantity, or about 60 to 70 parts

Dissolve the silver nitrate in the ammonia water. Triturate in a mortar the sodium carbonate, gum arabic and 60 parts of glycerin, and to the triturate add the solution of the silver nitrate gradually and under constant rubbing. Put the mixture on a water-bath and heat to boiling, and then add the Venice turpentine, a little at a time, under constant agitation. Remove, and let cool. If too thick, add a few drops of glycerin and stir in well. After stamping expose the article to direct sunlight, or pass a hot smoothing iron over the stamped part.

HECTOGRAPH COMPOUND.

Gelatin	22½ parts
Water	40 “

Mix and set aside for one-half hour, add

Glycerin	70 parts
Place on a water bath, heat until dissolved and evaporate until the whole mass weighs	100 parts

Ink for Hectograph.

Resorcin blue	10 parts
Distilled water	85 “
Acetic acid	1 part

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Diamond Ink for Etching Glass.

Hydrofluoric acid is neutralized with ammonia water and an equal amount of hydrofluoric acid is then added with sufficient barium sulphate to slightly inspissate the fluid. Writing may be done with a steel pen.

Indestructible Ink for Writing on Glass.

1.

Gum shellac	5 parts
Alcohol	20 "
Borax	10 "
Distilled water	80 "
Methyl violet	$\frac{1}{5}$ part

The shellac is dissolved in the alcohol, and the borax in the water. The alcoholic solution previously slightly warmed, is then added to the borax solution, little by little, and as soon as the two solutions are thoroughly mixed, the methyl violet is added.

2.—White.

Barium sulphate	1 part
Solution sodium silicate	3 parts

2.—Black.

Higgins' India ink	1 part
Solution sodium silicate	2 parts

Glass Lettering Ink.

Zinc oxide	1 part
Liquid silex	10 parts

Mix and apply with a brush

Pencils for Writing on Glass.

Black —Lampblack, 1 part; yellow wax, 4 parts; tallow, 1 part.

White.—White lead, 4 parts; yellow wax, 2 parts; tallow, 1 part.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Light Blue —Turnbull's blue, 3 parts; yellow wax, 4 parts; tallow, 2 parts.

Dark Blue.—Prussian blue, 3 parts; mucilage 1 part; tallow, 2 parts.

Red.—Vermilion, 1 part; yellow wax, 2 parts; tallow, 1 part.

Yellow —Chrome yellow, 1 part; yellow wax, 2 parts; tallow, 2 parts.

Melt the wax and tallow and rub in the colors. The pencils are moulded and then dried to the desired consistency.

Ink for Zinc Labels.

Potassium chloride	60 parts
Copper sulphate	120 "
Anilin blue	1 part
Dilute acetic acid	100 parts
Distilled water	1800 "

Dissolve the potassium chloride and cupric sulphate in 1400 parts of the water. Mix the acid and the remainder of the water, and in the mixture dissolve the blue. Mix the two solution.

INK ERASING COMPOUND.

Solution A.

Citric acid	1 part
Water	8 parts

Solution B.

Chloride of lime	3 parts
Water	8 "

Place in a bottle with closely fitting stopper and set aside for a week. Decant the clear liquid.

Moisten the writing to be erased with solution A and let it remain for one to two minutes. Absorb with a clean white blotter and apply a drop of solution B. After writing has disappeared apply water and absorb with the blotter until all traces of the chemicals have been removed.

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LIBRARY PASTE.

White dextrin	80 parts
Gum arabic, powdered	6 "
Water	128 "
Oil of clove	$\frac{1}{500}$ part

Dissolve the dextrin and gum arabic in the water, which has been heated to about 160° F. Allow to cool and add the oil of clove. Store in a cool place for several weeks before using.

LIQUID GLUE.

Best glue	50 parts
Water	30 "

Let stand over night; apply gentle heat until dissolved, and add to the hot solution:

Nitric acid	3 parts
Glycerin	4 "

WATERPROOF GLUE.

Soak the best quality of carpenter's glue in water until it is well softened, but still retains its form. Pour off any excess of water and put the glue on a water-bath with sufficient linseed oil to reduce it to a jelly when melted. It should be stirred almost constantly while melting and put up in wide-mouthed bottles. This glue sets very slowly.

CEMENT FOR PORCELAIN, GLASS, ALABASTER, ETC.

(Diamond Cement.)

Isinglass	60 parts
Water	200 "
Alcohol	20 "

Cut the isinglass into small pieces and soak in the mixed liquids for twenty-four hours; apply gentle heat until fully dissolved. Make a solution of:

Gum ammoniac	10 parts
Alcohol	25 "
Water	25 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

and a solution of:

Gum mastic	20 parts
Absolute alcohol	120 "

Mix the gum ammoniac solution with the isinglass solution; boil and strain through flannel; add the gum mastic solution and evaporate on a water-bath until the mass weighs 240 parts, and pour in small wide-mouthed bottles.

To use the cement, place the bottle in hot water until the cement becomes liquid. Apply with a wooden stick upon the broken surface and tie together for twenty-four hours.

Cement for Pestle Handles.

Gum shellac	1 part
Gutta-percha	1 "
Rosin	1 "

To Cement Iron to Glass.

1.

Liquid glue, hot	20 parts
Boiled linseed oil	7 "

Mix thoroughly and apply while hot.

2.

Yellow beeswax	1 part
Rosin	4 parts
Red iron oxide (Crocus martis)	1 part

3.—Mendeljeff's.

Yellow beeswax	25 parts
Rosin	100 "
Red iron oxide (Crocus martis)	40 "

Alloy to "Cement" Metal Tubing to Glass.

Lead	6 parts
Antimony	8 "
Bismuth	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Aquarium Cement.

Litharge	10 parts
Plaster of Paris	10 “
Dry white sand	10 “
Rosin, finely powdered	1 part

Mix the substances, when wanted for use, into a stiff putty with boiled linseed oil.

This cement will stick to wood, stone, metal or glass, and hardens under water. It is also good for marine aquaria, as it resists the action of salt water. It is better not to use the tank until three days after it has been cemented.

Cement for Steam Fittings.

Red lead	4 parts
White lead	10 “
Powdered clay	8 “

Boiled linseed oil, enough to make a stiff paste.

To Cement Iron to Iron.

Pieces of iron can be cemented so firmly together as to withstand a blow of considerable force, by the following process, which is admirably adapted to the mending of cracked and broken iron mortars: Mix intimately 6 parts each of sulphur and white lead and 1 part of powdered borax. Wet the mass with strong sulphuric acid and apply at once a thin layer of it to the edge of each of the surfaces to be united. Bring the pieces together by strong pressure and leave them at rest, placing in such a position that they cannot fall apart.

In repairing a cracked mortar, insert, if possible, a thin wedge at the initial point of the crack, pushing it in carefully so as not to fracture the iron. Then place the cement in the crack, beginning at the lower end, and when the fissure is filled up remove the wedge. Now wind a few rolls of strong copper wire around the object and, with a pair of forceps, tighten the wire so as to bring the fractured edges into intimate contact. In a short time the joint will be as firm as any other part of the object.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

DURABLE BLACK STAIN FOR LABORATORY TABLES.

Solution A.

Copper sulphate	125 parts
Potassium chlorate	125 "
Water	1000 "

Solution B.

Aniline hydrochloride	75 parts
Water	500 "

Aniline Hydrochloride.

Aniline oil	60 parts
Hydrochloric acid	60 "
Water	500 "

The table must be in natural wood without paint or varnish. Two coats of solution A are applied hot and allowed to dry. Two coats of solution B are applied at an interval of one day A coat of raw linseed oil is then applied on the dry surface and thoroughly rubbed in. Finally, the table is washed with hot soap suds.

LUMINOUS PAINT FOR CLOCK DIALS, ETC.

Strontium thiosulphate is heated for about one-half hour over a strong bunsen flame. When cooled reduce to a very fine powder and keep in a well-stoppered bottle. When needed mix with about 2 parts of sandarac varnish and apply with a fine hair pencil.

All luminous paints require exposure to strong sunlight for a time to become active in the dark.

BLACKBOARD PAINT.

Gum shellac	4 parts
Lampblack	2 "
Emery powder, fine	2 "
Ultramarine	1 part
Alcohol	40 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dissolve the shellac in the spirit; place the lampblack, emery, and ultramarine on a cheese-cloth strainer, pour on part of the shellac solution, stirring constantly and gradually adding the rest of the solution until all the powders have passed through the strainer.

PAINT AND VARNISH REMOVER.

1.

Potassium hydroxide	16 parts
Acetone	40 "
Methylated spirit	20 "
Oil of turpentine	20 "
Petroleum spirit	20 "
Castor oil	10 "

Used by spreading thinly over old paint. After a few minutes the second application is made, when the softened paint can generally be removed with a blunt spatula.

2.

Soft soap	24 parts
Potassium carbonate	5 "
Alcohol	48 "
Water, enough to make	400 "

TO PREPARE A CLEAR VARNISH.

The filtering of alcoholic varnishes is accomplished with many difficulties. A satisfactory clear varnish is readily obtained by thoroughly shaking the varnish with about 5 per cent perfectly dry kaolin and setting aside in a warm place until the impurities have been carried to the bottom of the vessel by the heavy kaolin particles. Shellac varnishes are clarified by adding about 25 per cent of gasoline to dissolve certain waxy compounds present in the shellac. The supernatant gasoline solution has to be drawn off from the transparent shellac varnish before the latter is ready for use.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

LABEL VARNISH.

Pyroxylin (soluble gun cotton)	2 parts
Ether	40 parts
Alcohol	80 “
Camphor	1 part

Pour the ether over the pyroxylin, add the alcohol and finally add the camphor, and dissolve by agitation.

LIQUID FURNITURE POLISH.

Linseed oil	40 parts
Vinegar	6 “
Oil of turpentine	3 “
Hydrochloric acid	1 part
Alcohol	2 parts

Shake well before using.

FLOOR OR FURNITURE WAX.

Venice turpentine	1 part
Rosin	4 parts
Beeswax	16 “

SWEEPING COMPOUND.

Dry sawdust	80 parts
Paraffin oil	4 “
Paraffin wax	1 part
Coarse salt	4 parts
Eucalyptus oil	16 “
Sea salt	32 “

Warm the paraffin oil and mix with the melted wax, dissolve in the mixture any aniline color required, add the eucalyptus oil and saturate the sawdust. Then mix with the salt.

SILVERING OF MIRRORS.

Solution A.

Silver nitrate	15 parts
Rochelle salt	15 “
Distilled water	4000 “

Boil for six to eight minutes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Solution B.

Silver nitrate	20 parts
Distilled water	1000 “

Stir with a glass rod until dissolved and add

Ammonia water, a sufficient quantity (usually a few drops only) until solution becomes perfectly clear.

Now add:

Silver nitrate	15 parts

Stir until dissolved and add

Distilled water	3000 parts

Filter the solution through paper (glass funnel). Keep the solution in amber-colored glass-stoppered bottles.

Directions for Silvering: Clean the glass with ammonia water and running water. Place equal parts of solution A and B into a graduate, stir well and quickly pour on the middle of the glass to be silvered. The solution will spread over the flat surface of the glass. Leave it until the solution has precipitated, remove, place on edge for drying and when perfectly dry, coat with a thin layer of asphalt varnish.

TO PREVENT FOGGING OF MIRRORS, EYEGLASSES, WINDSHIELDS, ETC.

Potassium oleate	16 parts
Glycerin	8 “
Oil of turpentine	1 part

German green soap may be used instead of potassium oleate. Melt the oleate and glycerin together on a water bath, then add the turpentine. Should the paste be too thick, it may be thinned by the addition of more glycerin.

FROSTING FOR WINDOW GLASS.

Zinc sulphate	3 parts
Magnesium sulphate	5 “
Dextrine	2 “
Water	200 “

Dissolve and apply with a soft brush.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

WATERPROOFING OF CANVAS.

1.

Gelatin	5 parts
Water	40 "

2.

Alum	10 parts
Water	40 "

3.

Rosin (scrubbing) soap	4 parts
Water	40 "

Stretch the cloth moderately taut and flow over the above solutions in rotation.

WATERPROOFING OF PAPER.

Gelatin	1 part
Water	4 parts
Glycerin	1 part

Cover the paper on both sides with the warmed solution; after a few minutes, before it is fully dry, drop into the following solution:

Formaldehyde solution	75 parts
Water	500 "

WATERPROOFING OF BOOTS.

Heat fish oil, castor oil or tallow to about 250° F. over a naked fire, and then add about one-fifth of the weight of the oil taken of either vulcanized or raw India rubber, stirring well until the latter is dissolved. To color, a little printer's ink may be used. One or two applications of this are sufficient to thoroughly waterproof a pair of boots for a season. Boots thus treated will take a common shoe blacking afterwards with ease.

IMPERVIOUS CORKS.

The usual procedure for treatment with paraffin is to immerse the dry corks in the melted substance; they should

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

be kept in the bath for some time and sunk by a porous disc of some kind. Corks treated in this way should be quite impervious to glycerin.

STOPPERS FOR CHEMICALS.

Suitable corks are saturated in a solution heated to 100° F. composed of

Gelatin	15 parts
Glycerin	25 "
Water	500 "

If corks are used for acids, they should be additionally treated with

Paraffin	10 parts
Petrolatum	2 "

SEALING WAX FOR BOTTLES.

Rosin	480 parts
Japan wax	60 "
Turpentine	30 "

Melt together in a water-bath.

To color above quantity, add

For green color: verdigris	45 parts
For red color: cinnabar	45 "
For blue color: Prussian blue	100 "
For yellow color: chrome yellow	40 "

TO REMOVE A TIGHTLY WEDGED GLASS STOPPER FROM THE NECK OF A BOTTLE.

Gently heat the neck of the bottle and remove the stopper while the neck is still warm and before the stopper becomes affected by the heat.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

BATTERY FLUIDS.

A. For the Carbon and Zinc Battery.

1. FOR ORDINARY USE.

Sodium bichromate	4 parts
Sulphuric acid, commercial	4 “
Water, cold	32 “

2 FOR USE WITH THE GALVANO–CAUTERY.

Sodium bichromate	4¼ parts
Sulphuric acid, commercial	9½ “
Water, cold	32 “

3. FOR MEDICAL BATTERIES.

Potassium bichromate, powdered	7½ parts
Sulphuric acid, commercial	8 “
Water	40 “

Add the acid in a thin stream, under constant stirring, to the water and dissolve the powdered potassium bichromate in the mixture.

B. For the Leclanché Battery.

Ammonium chloride	5 parts
Water, enough to make	32 “

FREEZING PREVENTIVES FOR AUTOMOBILES.

1.

Potassium carbonate	75 parts
Glycerin	50 “
Water	100 “

2.

Calcium chloride	4½ parts
Water, hot	8 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Wood alcohol	15 parts
Glycerin	15 “
Water	70 “

For a temperature *not* lower than 5° below zero.

4.

Wood alcohol	17 parts
Glycerin	17 “
Water	66 “

For a temperature lower than 15° below zero.

5.

(For acetylene generators.)

Calcium chloride	2 parts
Water	8 “

FREEZING MIXTURES.

1.

Potassium nitrate	10 parts
Ammonium chloride	30 “
Potassium chloride	60 “
Water	100 “

2.

Ammonium chloride	10 parts
Potassium nitrate	3 “
Potassium chlorate	20 “
Cold water	32 “

Mix the salt and add to the water. Will reduce the temperature of the water about 50° F.

FIRE EXTINGUISHERS.

Powders.

1.

Sodium chloride	43 parts
Alum	20 “
Sodium phosphate	5 “
Sodium carbonate	3½ “
Sodium silicate	20 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Potassium nitrate	60 parts
Sublimated sulphur	36 “
Charcoal powder	4 “
English red	1 part

Place in a round paper carton, holding about 5 pounds. Punch a hole in the center and push one end of a fuse cord (about 4 inches) into the mixture, leaving the other end (about 6 inches) extend on the outside. In case of fire, the mixture is set on fire by the fuse cord. The burning of the mixture uses up the oxygen in the air and thus extinguishes the flames. To be used in closed rooms only.

Liquid.

1.

Calcium chloride, crude	20 parts
Sodium chloride, crude	5 “
Water	75 “

To be used with a hand spray in case of fire.

2.

Carbon tetrachloride	a convenient quantity

To be used with a hand spray in case of fire.

3.

Sodium bicarbonate	8 parts
Sulphuric acid, crude	2 “
Water	128 “

To be used with the Babcock spray.

FIREPROOFING OF PAPER.

Ammonium sulphate	4 parts
Sodium borate	1 part
Boric acid	1½ parts
Water	4 “

The paper is immersed in the hot solution until completely saturated and dried.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

FIREPROOFING OF WOOD.

Lime, fresh slaked	40	parts
Sodium chloride	10	“
Alum	10	“
Solution of sodium silicate	10	“
Sodium wolframate	10	“

Mix.

FIREPROOFING OF TEXTILE MATERIALS.

Ammonium sulphate	8	parts
Ammonium carbonate	$2\frac{1}{2}$	“
Boric acid	3	“
Borax	2	“
Starch	2	“
Water	100	“

TO CLEAN MARBLE SLABS.

Grease spots are removed by a thick mixture of magnesia and gasoline spread over the surface, say $\frac{3}{8}$ of an inch thick. Let it remain on the stone an hour or two, then remove the dried crust of magnesia. Stains from extracts may be removed by a thick paste of talcum, white lead, lemon juice and either citric, tartaric or oxalic acid, thinned with alcohol. If this fails, try a mixture of barium hyperoxide and dilute sulphuric acid mixed at the lowest available temperature and avoiding any excess of acid. Use as in the case of the magnesia mixture above spoken of. The stone will have to be repolished, using a mixture of “putty” and paraffin oil.

KID GLOVE CLEANSER.

Stearic acid	5	parts
Carbon tetrachloride	75	parts
Ammonia water	20	“

Shake before using.

STRAW HAT CLEANSER.

Sodium bisulphate	10	parts
Tartaric acid	2	“
Borax	10	“

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Moisten a small quantity of the powder with water and apply this mixture with a wet brush.

TO CLEAN SALIVA EJECTOR TUBES.

Place in 10 per cent hydrochloric acid for a few hours and wash in running water.

OIL STONE LUBRICANT.

Neatsfoot oil	1 part
Fresh lead shavings, a sufficient quantity.	

Place in bottle and expose to sunlight for some weeks.

DISINFECTANT SOLUTIONS: "FOUR CHLORIDES."

Alum	10 parts
Sodium carbonate	10 "
Ammonium chloride	2 "
Sodium chloride	2 "
Zinc chloride	1 part
Hydrochloric acid, crude, a sufficient quantity.	
Water, enough to make	125 parts

Dissolve the alum in 50 parts of hot water, add the sodium carbonate which gives a precipitate of ammonium hydrate. Hydrochloric acid is now added in sufficient quantity under constant stirring until the precipitate is dissolved and converted into aluminum chloride. The other salts are dissolved in the remainder of the water and added to the first solution.

A suitable strength of the solution for ordinary disinfectant purposes (rooms, clothing, etc.) is made by mixing 1 pint of the concentrated solution with 1 gallon of water.

DISINFECTING POWDER FOR STABLES, LATRINES, ETC.

Fresh slaked lime	75 parts
Plaster of Paris	30 "
Sulphate of iron, powder	20 "
Carbolic acid, crude	10 "

Mix thoroughly.

To be used dry.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

DISINFECTION OF ROOMS.

The room to be disinfected should have a temperature of 65° F. or more, and the air present must contain at least 75 per cent of moisture. This humidity can be produced by placing pans of steaming hot water about the room. Drawers, closet doors, etc., should be opened and the furniture moved from the walls. Set on the floor in the middle of the room a large tin bucket, in which place a tin can of suitable capacity. Put into the can 6 ounces of potassium permanganate crystals and pour over them 1 pint of commercial formaldehyde solution. This quantity is sufficient for every thousand cubic feet of air space. The operator should leave the room at once, as large quantities of formaldehyde gas are immediately evolved. The room must be closed air tight and not opened for at least six hours. Furniture, draperies, carpets, pictures, etc., are not damaged by this method of disinfection. After the disinfection is completed the formaldehyde gas can be neutralized by ammonia, so as to render the room fit for occupation. This may be readily accomplished by placing in a suitable vessel 2 pounds of freshly burnt lime, 7 pints of boiling water and 3 pints of strong ammonia water. After one hour's exposure to the ammonia vapors the room should be well aired.

FORMULAS FOR MAKING NEGATIVES, LANTERN SLIDES AND ROENTGEN-RAY WORK.

Developer for Contrast Work, Lantern Slides, Etc.

Solution A.

Hot water, pure	18 parts
Metol	1 part
Hydrochinone	¼ "
Sodium sulphide, crystallized	6 parts

Solution B.

Water, pure	80 parts
Sodium carbonate, crystallized	5 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

To develop take:

Water, pure	2 parts
Solution A.	1 part
Solution B.	2 parts

Developer for View Work.

Solution A.

Water, pure	64 parts
Eikonogen	1 part
Hydrochinone	¼ “
Sodium sulphide, crystallized	2½ parts

Solution B.

Water, pure	64 parts
Potassium carbonate (dry)	2½ “

To develop take:

Solution A.	2 parts
Solution B.	1 part

and add developer (solution previously used) a sufficient quantity to produce best results.

Quickly Acting Photographic Developer.

A soft effect is obtained in negatives of portraits by using iron oxalate developer containing a small quantity of sodium thiosulphate. The following is said to give a good developer:

Solution of ferrous sulphate (1:3)	25 cc.
Solution of potassium oxalate (1:3 and containing 5 drops of chemically pure sulphuric acid)	75 “
Solution of potassium bromide (1:10)	4 drops
Solution of sodium thiosulphate (not more concentrated than 1:200)	12 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

This solution develops the plate two or three times more rapidly than those ordinarily used and gives finer gradations in the tones. Contrasts can be heightened by increasing the quantity of potassium bromide, *i. e.*, 12 drops of potassium bromide solution and 12 drops of sodium thiosulphate to 100 cc of the developer.

Methods for Quick Developing of Films, Plates, Etc.

For films one may use the widely advertised developing machine, or, better still, the new system of tank development introduced within the past few years. By this method the film is wound up in broad daylight, by means of a transfer box, in a light tight apron, and immersed in a cup containing the developing solution and allowed to develop, the period depending upon the formula used and its temperature. When development is completed the developer is poured off and the cup filled with water two or three times to rinse off the film, which is then transferred to the fixing solution, all being done in daylight.

With plates, practically the same method of procedure is followed except that a dark closet is required, so that the plate may be safely transferred from the holders to the developing tank. This having been done, the tank may be covered and the room made light and the plates left until development is completed, and the time required for this having been determined beforehand by regulating the strength and temperature of the developing solution.

In selecting a developer for this kind of work it is of the utmost importance to have one which has absolutely no tendency to fog and which is not seriously affected by changes in temperature. Given a developing agent with these characteristics, a formula should be used which is susceptible to many modifications.

No developing agent fills the first mentioned specification as well as Edinol and the following formula cannot be equaled for versatility:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Water	2500 parts
Acetone sulphite	75 "
Sodium sulphite (dry)	225 "
Edinol	30 "
Hydroquinone	15 "
Potassium bromide	7 "
Potassium carbonate	480 "

For regular tray development, dilute this stock solution with 5 parts of water.

For machine development, dilute with 6 parts of water and develop for six minutes at a temperature of 65° F.

For tank development (either plates or film) to take ten minutes, dilute with 10 parts of water and have temperature at 65° F.

For the tank development (plates or film) to take thirty minutes, dilute with 25 parts of water and have temperature at 65° F.

Any other state of dilution may be used and development may be prolonged for several hours if desired. In using extreme dilutions, however, it is advisable to wet the plate thoroughly before immersing it in the developer. This will prevent "freaks," which are irregular streaks and which sometimes occur with certain makes of plates.

In addition to the above directions it may be well to mention, especially for the benefit of roentgen-ray workers, the following modifications: to increase contrast omit the acetone sulphite. To increase softness omit the hydroquinone and add an equivalent quantity of edinol.

Another method of time development is the factorial system. The factor being a certain number, which when multiplied by the number of seconds elapsed between the immersion of the plate in the developer and the first appearance of the image, gives the time in which the development should be completed. The factor of the above formula is 15.

Besides the simplified methods of development, photographic printing has also been made much easier since the introduction of the various so-called gaslight papers.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

With these papers any negative may be printed by any kind of artificial light in a few seconds and the developing and printing done in a few minutes longer. The directions for using papers of this kind are so complete and so simple that it is unnecessary to go into the matter here, except to give a formula with which superb results can be obtained and which keeps indefinitely even in open bottles. It is as follows:

Water	4000	parts
Edinol	30	“
Acetone sulphite	150	
Sodium carbonate (dry)	225	“

Bromide, 1 per cent, 5 drops to 30 parts of solution.

After adopting the above simple method of working it is unnecessary to sit up all night washing negatives and prints. The new hypo-destroyer “Bayer” will be found to reduce the time of washing to eight minutes.

Plain Fixing Bath.

The plain fixing bath is a solution of sodium hyposulphate of a strength of about 5 or 6 parts to 16 parts of water. A fully saturated solution diluted with an equal quantity of water is about this strength. The plate should be left in the fixing bath for several minutes after it appears to be cleared; as long as it took to fix would not be too much. Neglect of this precaution may lead to the formation of insoluble compounds in the film, which, although not visible at first, may in time result in stains or even total decay of the negative. Commercial hyposulphite of soda usually contains foreign matter, which, if allowed to remain in the solution, will cause spots on the negative. Filter before use. If the regular fixing bath is too strong and not stirred before use, it will at times cause parallel lines on the negatives that were fixed in grooved fixing boxes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

A cool fixing bath can be prepared by dissolving a fresh lot of "hypo" for each batch of plates. This is of benefit during the hot weather.

Acid Fixing Bath.

Owing to the quality of the water in some localities some workmen prefer an acid fixing bath. The following is good and remains clear (mix in order given):

Water (about)	960 parts
Sulphuric acid	3 "
Sodium sulphite	32 "

When dissolved, add:

Sodium hyposulphite	32 parts
Water, to make	160 "

Acid Chrome-alum Fixing Bath.

(For hot weather use.)

Water (about)	800 parts
Sulphuric acid	3 "
Sodium sulphite	32 "

When dissolved, add:

Sodium hyposulphite	256 parts

Dissolve and then add:

Chrome-alum, from	8 to 15 parts

previously dissolved in 120 parts of water. Then add water to make 1280 parts.

Intensification.

No. 1 —	Bichloride of mercury	12 parts
	Bromide of potassium	12 "
	Water	750 "
No. 2.—	Sulphite of soda, dry	2 "
	Water	16 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

After the negative is well fixed and washed immerse in No. 1 until it has become thoroughly whitened, and after rinsing carefully place it in No. 2, leaving it there until entirely cleared. In case sufficient intensification has not been gained, wash for ten minutes, repeat the operation and finally wash well. If after intensification the negative is too dense it may be reduced by placing it for a few seconds in water 16 parts, hyposulphite 1 part.

If the negative has not been thoroughly fixed and washed before intensification, stains will ensue.

Reduction.

A.—Hyposulphite of soda	2 parts
Water	32 "
B.—Potassium ferricyanide	2 parts
Water	32 "

As this solution is affected by light, the bottle containing it should be of amber color or wrapped in opaque paper and kept in the dark when not in use:

A	8 parts
B	1 part

Use in subdued daylight.

The negative can be placed in this solution directly after fixing. If a dry negative is to be reduced, it must be soaked in water for at least half an hour before applying the solution. To avoid streaks, always rinse the negative before holding it up for examination. As soon as sufficiently reduced wash thoroughly.

Iron Clearing Solution.

To remove yellow stain caused by Pyro or Hydrochinon developer, wash well to free from hypo and place in the following solution, until stain is gone, then wash well.

Powdered alum	1 part
Sulphuric acid, C. P.	1 "
Ferrous sulphate, pure	3 parts
Water	20 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dry Plates.

For snapshots, landscapes and general outdoor work: Cramer's Crown plates, Hammer's fast plates or Seed's No. 27 plates.

For copying drawings, interior views and all time exposures: Cramer's Banner, Hammer's slow plates and Seed's No. 23 plates.

Lantern Slide Plates.

These special plates are made by Cramer, Hammer or Seed and are suitable for making slides by contact or reduction.

For all view and landscape work the average kodak with film attachment gives perhaps the most universal satisfaction. For interior work, such as copying and scientific work, an ordinary camera, strongly constructed and provided with a good lens (Goerz, Zeiss, Cooke, etc.) is indicated. For daylight work, solar paper is best adapted, while for night work, velox paper is to be used.

Photographic Blueprint Paper.

The ordinary photographic blueprint paper is made as follows. Two solutions are prepared:

Solution A.

Potassium ferricyanide	10 parts
Distilled water	32 "

Solution B.

Iron ammonium citrate	15 parts
Distilled water	32 "

Mix when wanted for use. Filter and apply to the surface of the paper by means of a brush or a piece of cotton wool. Let the paper dry in a dark place and store away from the light. No developer is required for this paper. After exposure it is placed in water to wash out the undecomposed iron salts. It may be improved by immersion in

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

diluted hydrochloric acid, after which it must be again thoroughly washed in water.

Varnish for Celluloid Negatives.

Gum shellac, pale orange	4 parts
Methyl alcohol	6 “

Dissolve and add:

Ammonia water	6 parts
Boiling water	8 “
Glycerin	$\frac{1}{4}$ “

Allow to stand for a week and filter. After the negative is fixed and washed it is thoroughly drained. The varnish is then poured into a dish and the negative immersed and allowed to soak for a few minutes. It is then taken out and pinned by one corner to the edge of a shelf or another convenient article to dry.

Transparent Cement for Photographs.

Gum tragacanth, powdered	1 part
Gum arabic, best selected	4 parts
Glycerin	4 “
Water, distilled	32 “

Dissolve the tragacanth in one-half of the water, the gum arabic in the remainder and mix the solutions, completing by adding the glycerin. If the gum arabic is not first class you may have to filter the solution through absorbant cotton. The white of a fresh egg dissolved in a little distilled water is also an excellent medium for attaching photographic prints to glass, face foremost.

Paste for Mounting Photographic Prints.

1.

Nelson's photographic gelatin	4 parts
Glycerin	1 part
Alcohol	5 parts
Water	16 “

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dissolve the gelatine in water, add the glycerin and finally the alcohol.

2.

In mounting by the "dry method" the paper or a part of it is previously varnished and the print having been put in place, is subjected to heat in a press. This softens the resins in the varnish and makes perfect contact between the print and the mount. The resinified paper is made by brushing fine tissue paper with the following solution:

White gum shellac	30 parts
Gum elemi	3 "
Canada balsam	5 "
Alcohol	1000 "

To Transfer Photographs, Engravings, Etc., from Paper to Glass in Lines of Silver.

Lightly silver a sheet of glass by any of the numerous processes in use (see page 280). Then float on the silvered surface a very thin coating of Syrian asphaltum (obtainable from any dealer in photographic supplies) dissolved in benzol. This should be done in very subdued light, best of all in the dark. When the asphaltum is dry, lay on it the picture to be transferred and expose the whole to the sunlight for several hours. The asphalt, by its peculiar property, is thus rendered insoluble in direct proportion to the quantity of light received and, as a consequence, the parts protected by the lines of the picture are left soluble, while the other parts become insoluble. After exposure, the plate is placed in benzol and the soluble parts of asphaltum dissolved away. It is then rinsed and put in nitric acid for a moment, which dissolves the silver thus exposed. Rinsing in water completes the operation.

Making of Hand Lantern Slides for Immediate Use.

(After Dr. G. V. Black.)

The materials necessary for this work are: Hard rolled, fine, tissue tracing paper.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Ordinary cover glasses for lantern slides (thin, white glass is preferable).

Hard pencils No. H. B. and H. BBB., charcoal and paper points.

India ink and "crowquill" pens.

Water colors and fine har pencils.

Xylol and Canada balsam.

The India ink should be diluted with water proportionately so as to make five different grades. The weak solution is used for making a very light shade, the others grading blacker. All water colors can be used freely with the exception of yellow. The latter must be used very carefully, as it will kill light badly.

The picture is made by copying or tracing on the tracing paper with pencils, ink or water colors. Dr. Black described in the following the details of making colored slides: "This drawing is of a lower bicuspid tooth in which I noticed a very peculiar pulp chamber. In order to bring this out a little plainer I will use a lead pencil with which to outline the pulp chamber, doing this very lightly, and then I will color it lightly with red. I will outline the enamel also with a lead pencil, rather lightly, and go over it lightly with a pencil so as to make the enamel stand out a little from the dentine, showing it to be different; then I will take the red ink and my brush, making sure that the latter is not very wet, and lightly color the pulp chamber. It is best to do any such coloring last. It is not necessary to the drawing particularly that we color the pulp chamber, but a fresh tint catches the eye. We must not make this paper too wet, for if we do it will all crinkle up in drying. When we use a brush with India ink the paper will be all crumpled up and not fit for use. How will we straighten it out? Let it dry to fix the ink, then lay it on water and saturate the entire paper and it will straighten out. It may then be dried between pieces of blotting paper under a light compress, after which we can add anything further we wish. Now my picture is completed. I will make a second one of different

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

design, a large pulp chamber in a second bicuspid, a very different form of tooth in which I will make the enamel a little bit stronger in its demarcation from the dentine by just a little shading with a pencil. This pulp chamber I will not color. I will put this on a cover glass, place on it a mat and cover this with another cover glass, having the picture and the mat between two cover glasses. Around the whole I will place a couple of rubber bands. This is now ready for the screen."

To make a picture as transparent as possible, it is now dropped into xylol and left there for about five minutes. Two cover glasses are laid on blotting paper and on each is placed a small quantity of Canada balsam, the same as is used in mounting microscopic specimens, care being taken not to include any air bubbles. Remove the picture from the xylol and place it on the balsam cover as nearly to the center as possible and place a second balsam cover slide, face downward, over the picture. Press the two together lightly and carefully put a rubber band on each end so as to hold the slides firmly together. Place the slides on their edge for drying. After a few days' drying, the edges may now be enclosed in the usual binding. All pressed out balsam must be carefully removed.

Sizing Preparation for Lantern Screens.

White glue	1 part
Zinc oxide	2 parts
Glycerin	1 part
Water	8 parts

Macerate the glue in the water, boil until dissolved and add the glycerin. Mix the zinc oxide with a small quantity of the solution until a smooth paste is obtained and add the remainder of the solution under constant stirring. Have the fabric stretched on a smooth surface and apply while hot. Leave on the stretcher until perfectly dry. One gallon of this sizing will cover a screen 10 feet square.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

FLASHLIGHT POWDER.

Potassium perchlorate	1 part
Magnesium powder, finely sifted	2 parts

Mix very carefully, preferably with a card or feather. (Potassium perchlorate is a powerful oxidizing agent and is apt to "go off" prematurely unless tenderly handled.) In using this powder the lens should be protected with a screen or greenish-yellow color.

TO REMOVE PHOTOGRAPHIC STAINS FROM HANDS.

First wash the hands in a thin solution of potassium permanganate, then rinse in a solution of oxalic acid, and lastly wash with hydrogen peroxide.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER X.

TABLES.

WEIGHTS AND MEASURES.

THE system of weights and measures as used in the United States was standardized in 1836, when the then Secretary each of the Treasury was authorized by Congress to furnish state of the Union with a complete set of revised standards for weights, liquid measures, and measures of length. These various methods of weights and measures are quite confusing when an examination of their comparative units is made—that is, it is perplexing to find that a pound is not a pint, an ounce does not equal a fluidounce, and a drop is neither a grain nor a minim.

The United States National Prototype Standards, from which all weights and measures now used in this country are derived, are the meter and the kilogram, and they are preserved in the custody of the National Bureau of Standards at Washington. The United States meter and kilogram are identical with the international Standards of the same capacity.

The United States standards of weights and measures are:

The apothecaries' or troy ounce = 480 grains.
The commercial or avoirdupois ounce = 437.5 grains.
The apothecaries' fluidounce (identical with the fluidounce of the liquid gallon) = 480 minims.

The weights and measures used in the British Pharmacopeia are the Imperial weights and measures, legal for commercial purposes in the British Empire. The English apothecaries' weights are the same as those used in the United States.

Apothecaries' Weight.

Pound.		Troy ounces.		Drams.		Scruples.		Troy grains.
℔ 1	=	12	=	96	=	288	=	5760
		℥ 1	=	8	=	24	=	480
				ʒ 1	=	3	=	60
						℈ 1	=	gr. 20

Troy Weight.

Pound.		Troy ounces.		Pennyweights.		Troy grains.
℔ 1	=	12	=	240	=	5760
		℥ 1	=	20	=	480
4 troy grains	=	7 carat.		dwt. 1	=	gr. 24

Avoirdupois Weight.

Pound		Ounces		Drams		Troy grains.
℔ 1	=	16	=	256	=	7000.
		oz. 1	=	16	=	437.5
				dr. 1	=	gr. 27.34375

Relative Value of Troy and Avoirdupois Pounds.

1 troy pound = 0.822857 avoirdupois pound.
1 avoirdupois pound = 1.215277 troy pounds.

Apothecaries' or Wine Measure (United States).

Gallon.		Pints.		Fluidounces.		Fluidrams.		Minims.		Cubic inches.
Cong. 1	=	8	=	128	=	1024	=	61440	=	231
		O 1	=	16	=	128	=	7680	=	28.875
				fl℥ 1	=	8	=	480	=	1.8047
						flʒ 1	=	♏ 60	=	.2256

Liquid Measure.

1 gallon = 4 quarts.
1 quart = 2 pints.
1 pint = 4 gills.
1 gill = 4 fluidounces.

Imperial Measure (British Pharmacopeia).

Gallon.		Pints.		Fluidounces.		Fluidrams.		Minims.
1	=	8	=	160	=	1280	=	76800
		1	=	20	=	160	=	9600
				1	=	8	=	480
						1	=	60

The Metric System.

The metric or decimal system of weights and measures originated with Prince de Talleyrand, Bishop of Autun, in 1790. Its almost universal adoption by civilized nations, its legality (though not compulsion) in England and the

United States,[1] and its adoption by the United States Pharmacopeia of 1890 demand that it should be understood by the progressive practicing physician. Except in the English-speaking world, it is the only system of weights and measures used for governmental, statistical, and scientific purposes. It is based upon the decimal system—that is, the denominations increase by tens and decrease by tenths. The starting point is the unit of linear measures, the *meter*, which represents one-ten-millionth of the polar quadrant of the earth—that is, the distance from the equator to the poles—and is equivalent to 39.37 English inches. The *gram* (gm.) is the unit of weight; the *liter*, or capacity (although the *cubic centimeter* is oftener preferably used); the *are*, of surface measure. The denominations representing the subdivisions of any unit are expressed by prefixing the Latin numerals, *deci*, *centi*, and *milli* to the unit—meaning respectively one-tenth, one-hundredth, and one-thousandth; the multiples are expressed by prefixing the Greek numerals *deka*, *hecto*, *kilo* and *myria*—meaning ten, hundred, thousand, and ten thousand.

The gram is derived as follows: The meter is divided into one hundred equal parts, called *centimeters*. On one centimeter as a base a cube is erected, having for its three dimensions one centimeter (cm.) each. The contents of this cube will be one cubic centimeter (cc), measuring one milliliter. This quantity of distilled water at its maximum density (39.2° F., 4° C.) and 30 inches barometric pressure weighs one gram, or 15,432 grains.

The liter is derived as follows: The meter is divided into ten equal parts, called *decimeters*. On one decimeter as a base a cube is erected, having for its three dimensions one decimeter (dm.) each. The contents of this cube will be one cubic decimeter ($dm.^3$), the capacity of which is one liter, equivalent to 1000 cubic centimeters, or 33.81 fluidounces, or 2.113 pints. One liter of distilled water at 4° C. and 30 inches barometric pressure weighs 1000 grams, or 1 kilogram, or 2.2 pounds avoirdupois, or 15,432 grains.

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[1] The metric system was legalized in Great Britain in 1864, and in the United States by act of Congress in 1866.

Metric Weights and Measures.

The meter, or unit of length, = 39.37043 inches.
The liter, or unit of capacity, = 33.814 fluidounces (U. S.).
The gram, or unit of weight, = 15.432348 troy grains.

Measures of Length.

		English inches.			English inches.
Millimeter (mm.)	=	.03937	Decimeter (dm.)	=	3.93704
Centimeter (cm.)	=	.39370	Meter (m.)	=	39.37043

Kilometer = 39.370.43 English inches.

Measures of Capacity.

		English cubic inches.			English cubic inches.
Milliliter (cc.)	=	.06102	Deciliter (dl.)	=	6.10280
Centiliter (cl.)	=	.61028	Liter (L.)	=	61.02800

Hectoliter = 6102.8 English cubic inches.

Measures of Weight.

		Troy grains.			Troy grains.
Milligram (mg.)	=	.0154	Decigram (dg.)	=	1.5432
Centigram (cg.)	=	.1543	Gram (gm.)	=	15.4324

Kilogram = 15432.34 troy grains.

Apothecaries' Weight and Metric Equivalents.

$\frac{1}{100}$ grain	=	0.0006	gram.	15.4	grains	=	1.	gram.
$\frac{1}{64}$ “	=	0.001	“	20	“	=	1.3	grams.
$\frac{1}{50}$ “	=	0.0013	“	24	“	=	1.55	“
$\frac{1}{40}$ “	“	0.0016	“	30	“	=	1.94	“
$\frac{1}{32}$ “	=	0.002	“	40	“	=	2.6	“
$\frac{1}{20}$ “	=	0.003	“	45	“	=	2.92	“
$\frac{1}{16}$ “	=	0.004	“	50	“	=	3.23	“
$\frac{1}{12}$ “	=	0.005	“	60	“ (1 dram)			
$\frac{1}{10}$ “	=	0.006	“			=	3.89	“
$\frac{1}{8}$ “	=	0.008	“	$1\frac{1}{2}$	drams	=	5.58	“
$\frac{1}{6}$ “	=	0.011	“	$1\frac{3}{4}$	“	=	6.81	“
$\frac{1}{5}$ “	=	0.012	“	2	“	=	7.78	“
$\frac{1}{4}$ “	=	0.015	“	$2\frac{1}{2}$	“	=	9.72	“
$\frac{1}{3}$ “	=	0.022	“	3	“	=	11.65	“
$\frac{1}{2}$ “	=	0.032	“	4	“	=	15.55	“
$\frac{3}{4}$ “	=	0.048	“	5	“	=	19.43	“
1 “	=	0.065	“	6	“	=	23.3	“
2 grains	=	0.13	“	1	ounce (480 grains)			
3 “	=	0.2	“			=	31.1	“
4 “	=	0.26	“	2	ounces	=	62.2	“
5 “	=	0.32	“	3	“	=	93.3	“
6 “	=	0.39	“	4	“	=	124.4	“
8 “	=	0.52	“	6	“	=	186.6	“
10 “	=	0.65	“	8	“	=	248.8	“
12 “	=	0.78	“	10	“	=	311.	“
15 “	=	0.97	“	12	“	=	373.2	“

Apothecaries' Measure and Metric Equivalents.

1 minim	= 0.06 cc.	1¼ fluidrams	= 4.65 cc.
2 minims	= 0.12 "	1½ "	= 5.60 "
3 "	= 0.18 "	1.. "	= 6.50 "
4 "	= 0.24 "	2 "	= 7.50 "
5 "	= 0.30 "	3 "	= 11.25 "
6 "	= 0.36 "	4 "	= 15.00 "
7 "	= 0.42 "	8 "	
8 "	= 0.50 "	(1 fluidoz.)	= 30.00 "
9 "	= 0.55 "	(more exactly)	= 29.57 "
10 "	= 0.60 "	2 fluidounces	= 59.15 "
15 "	= 0.92 "	3 "	= 88.72 "
20 "	= 1.25 "	4 "	= 118.29 "
25 "	= 1.54 "	8 "	= 236.59 "
30 "	= 1.90 "	16 "	= 236.59 "
40 "	= 2.50 "	16 "	
45 "	= 2.80 "	(1 pint)	= 473.18 "
50 "	= 3.10 "	32 "	= 946.36 "
60 minims		128 "	
(1 fluidram)	= 3.70 "	(1 gallon)	= 3785.43 "

Weight Equivalents.

To convert grains into grams multiply by	0.065
To convert grams into grains multiply by	15.5
To convert drams into grams multiply by	3.9
To convert ounces (avoirdupois) into grams multiply by . . .	28.4
To convert pounds (avoirdupois) into grams multiply by . .	543.6

Measure Equivalents.

To convert cubic centimeters into grains multiply by	15.5
To convert cubic centimeters into drams multiply by	0.26
To convert cubic centimeters into ounces (avoirdupois) multiply by	9.03
To convert pints into cubic centimeters multiply by	473.
To convert liters into ounces (avoirdupois) multiply by . . .	35.3
To convert gallons into liters multiply by	3.8

Approximate Measures.

A drop equals roughly	1 minim.
A teaspoonful	= 1 fluidram.
A dessertspoonful	= 2 fluidrams.
A tablespoonful	= ½ fluidounce.
A wineglassful	= 2 fluidounces.
A teacupful	= 4 fluidounces.
A tumblerful	= 8 fluidounces.
A handful	= 4 ounces.

Percentage Solution Table.

Showing the quantity of drug and water to use for preparing aqueous solutions of different strengths. In these calculations 456 grains have been taken as the weight of one fluidounce of distilled water at ordinary temperature.

Fluidoz. water.	Gr. for 1-1000 per cent sol'n.	Gr. for 1-500 per cent sol'n.	Gr. for ½ per cent sol'n.	Gr. for 1 per cent sol'n.	Gr. for 2 per cent sol'n.	Gr. for 3 per cent sol'n.	Gr. for 4 per cent sol'n.	Gr. for 5 per cent sol'n.	Gr. for 10 per cent. sol'n.	Gr. for 20 per cent sol'n.	Gr. for 25 per cent sol'n.	Gr. for 50 per cent sol'n.
½	0.228	0.457	1.14	2.3	4.6	7.0	9.5	12	25.3	57	76	228
1	0.456	0.913	2.29	4.6	9.3	14.1	19	24	50.6	114	152	456
2	0.912	1.83	4.58	9.2	18.6	28.2	38	48	101.3	228	304	912
3	1.37	2.74	6.87	13.8	27.9	42.3	57	72	151.9	342	456	1368
4	1.82	3.65	9.16	18.4	37.2	56.4	76	96	202.6	456	608	1824
6	2.74	5.48	13.75	27.6	55.8	84.6	114	144	303.9	684	912	2736
8	3.65	7.31	18.32	36.8	74.4	112.8	152	192	405.2	912	1216	3648
12	5.47	10.96	27.5	55.2	111.6	169.2	228	288	607.9	1368	1824	5472
16	7.3	14.6	36.64	73.6	148.8	225.6	304	384	810.4	1824	2430	7296

Short Rules for Determining Percentages in Mixtures.

Multiply 456 by the percentage desired and point off two right-hand figures. The figures at the left of separatrix will give the number of grains or drops, 456 being the number of grains to the ounce of water. Examples: 456×4=1824; 18.24=18¼; 18¼ grains to an ounce of liquid, a 4 per cent solution.

Cabalistic Signs Used in Prescription Writing.

℔	libra	a pound
℥	uncia	an ounce
ʒ	drachma	a drachm
℈	scrupulus	a scruple
gr.	granum	a grain
C	congius	a gallon
O	octarius	a pint
f℥	fluid uncia	a fluidounce
fʒ	fluid drachma	a fluidrachm
♏	minim	a drop
gtt	gutta	a drop
ss	semis	half

Latin Numerals.

All Latin numbers are expressed by one, or a combination of two or more, of the following letters: I, V, X, L, C, D, and M. I means 1; V, 5; X, 10; L, 50; C, 100; D, 500; and M, 1000. These should be written together as capital letters, but in prescriptions we find them usually written as small letters, or in print as "lower case" letters, and it is customary to write a single "i," or the final "i" when several numeral letters are used together, as a small "j." The letters are combined thus:

I	1	XX	20
II	2	XL	40
III	3	L	50
IV	4	LX	60
V	5	XC	90
VI	6	C	100
VII	7	CC	200
VIII	8	D	500
IX	9	DC	600
X	10	M	1000
XI	11	MCMXXIII	1923

Table of Solubility.

Name.	Water.	Alcohol.	Ether.	Glycerin.
Acetanilid	230	3.5	readily	
Acid arsenic	80	......	......	5
Acid benzoic	400	3	3.5	10
Acid boric	25	15	......	10
Acid carbolic	15	readily	readily	readily
Acid citric	1	1	50	readily
Acid salicylic	500	readily	readily	
Acid tannic	1	2	......	2
Acid tartaric	1	2.5	......	readily
Acid trichloracetic	readily	readily	readily	
Alum	12	......	......	3
Ammonium bromide	1.3			
Ammonium carbonate	4			
Ammonium chloride	3	......	......	5
Antipyrin	1	1	50	
Apomorphine hydrochloride	35	35		
Atropine sulphate	1	10	......	readily
Borax	17			
Camphor	......	readily	readily	
Caffein	80	50	300	
Chloral hydrate	readily	readily	readily	readily

Name.	Water.	Alcohol.	Ether.	Glycerin.
Cocaine hydrochloride	0.5	4		
Codeine Phosphate	4	difficult		
Copper sulphate	4	......	......	4
Iodine	5000	10	3	
Iodoform	......	50	6	
Iodol	5000	3	15	
Iron sulphate	2	......	......	4
Lithium carbonate	80			
Magnesium sulphate	1			
Menthol	difficult	readily	readily	
Mercuric chloride	16	3	4	15
Morphine hydrochloride	25	50	......	5
Morphine sulphate	20	......	......	5
Phenacetin	1400	16		
Pilocarpine hydrochloride	10	readily		
Potassium acetate	0.5	2		
Potassium bicarbonate	4	......	......	readily
Potassium bromide	2	200	......	4
Potassium carbonate	1	......	......	15
Potassium chlorate	16	130	......	32
Potassium iodide	1	12	......	2.5
Potassium permanganate	21	......	......	explosive
Potassium sulphate	10			
Potassium tartrate	1			
Quinine hydrochloride	34	3		
Quinine sulphate	800	90		
Resorcinol	1	0.5	0.5	5
Saccharin	250	25		
Salol	......	10	0.3	
Silver nitrate	0.6	10	......	readily
Sodium acetate	3	30	......	15
Sodium benzoate	2	......	......	13
Sodium bicarbonate	12	......	......	4
Sodium bromide	1.2	5	......	1
Sodium carbonate	2	......	......	5
Sodium chloride	3	......	......	difficult
Sodium phosphate	6	......	......	difficult
Sodium salicylate	1	6	......	readily
Sodium sulphate	3	......	......	1
Strychnine nitrate	90	70	......	25
Strychnine sulphate	31	65		
Sugar	0.5			
Sugar, milk	6			
Sulphonal	500	65	135	
Tartar emetic	17	......	......	readily
Thymol	1100	1	1	
Veratrin	......	4	7	100
Zinc sulphate	0.6	......	......	3

Number of Drops in a Fluidram.

Table showing number of drops in a fluidram of different liquids, with weight in grains and in grams:

Name.	Drops in 1 fluidram (60m)	Weight of 1 fluidram In grains.	In grams.
Acid. aceticum	108	58	3.75
Acid. aceticum dilut	68	55	3.56
Acid. hydrochlor	70	65	3.62
Acid. hydrochlor. dilut	60	56	3.49
Acid. lacticum	111	66	4.27
Acid. nitricum	102	77	4.98
Acid. nitricum dilut	60	58	3.62
Acid. sulphur	128	101	6.54
Acid. sulphur. aromat.	146	53	3.43
Acid. sulphur. dilut	60	58½	3.79
Æther fortior	176	39	2.52
Alcohol	146	44	2.85
Aqua	60	55	3.56
Aqua ammon. fortior	66	50	3.24
Chloroform. purificat	250	80	5.18
Creosotum	122	56½	3.66
Glycerinum	67	68	4.40
Hydrargyrum	150	760	49.24
Liq. potassi arsenitis	57	55	3.56
Oleum caryophylli	130	57	3.69
Oleum cinnamonic	126	53½	3.46
Oleum gaultheriæ	125	62	4.01
Phenol liquid	111	59	3.82
Spiritus ammon. aromat.	142	48	3.11
Syrupus	65	72	4.66
Tinctura aconiti	146	46	2.98
Tinctura digitalis	128	53	3.43
Tinctura ferri chloridi	150	53	3.43
Tinctura iodi	148	47	3.04
Tinctura opii	130	53	3.43
Tinctura zingiberis	144	46	2.98

THERMOMETRIC EQUIVALENTS.

To reduce Centigrade degrees to those of Fahrenheit, multiply by 9, divide by 5 and add 32; or, degrees Centigrade ×1.8+32=degrees Fahrenheit.

To reduce Fahrenheit degrees to those of Centigrade, subtract 32, multiply by 5, and divide by 9; or, degrees —32÷1.8=degrees Centrigrade.

Fahrenheit and Centigrade Scales.

°C	°F	°C	°F	°C	°F	°C	°F
—20	—4.0	5	41.0	30	86.0	55	131.0
—19	—2.2	6	42.8	31	87.8	56	132.8
—18	—0.4	7	44.6	32	89.6	57	134.6
—17	1.4	8	46.4	33	91.4	58	136.4
—16	3.2	9	48.2	34	93.2	59	138.2
—15	5.0	10	50.0	35	95.0	60	140.0
—14	6.8	11	51.8	36	96.8	61	141.8
—13	8.6	12	53.6	37	98.6	62	143.6
—12	10.4	13	55.4	38	100.4	63	145.4
—11	12.2	14	57.2	39	102.2	64	147.2
—10	14.0	15	59.0	40	104.0	65	149.0
— 9	15.8	16	60.8	41	105.8	66	150.8
— 8	17.6	17	62.6	42	107.6	67	152.6
— 7	19.4	18	64.4	43	109.4	68	154.4
— 6	21.2	19	66.2	44	111.2	69	156.2
— 5	23.0	20	68.0	45	113.0	70	158.0
— 4	24.8	21	69.8	46	114.8	71	159.8
— 3	26.6	22	71.6	47	116.6	72	161.6
— 2	28.4	23	73.4	48	118.4	73	163.4
— 1	30.2	24	75.2	49	120.2	74	165.2
0	32.0	25	77.0	50	122.0	75	167.0
1	33.8	26	78.8	51	123.8	76	168.8
2	35.6	27	80.6	52	125.6	77	170.6
3	37.4	28	82.4	53	127.4	78	172.4
4	39.2	29	84.2	54	129.2	79	174.2

Fahrenheit and Centigrade Scales.—(*Continued.*)

°C	°F	°C	°F	°C	°F	°C	°F
80	176.0	114	237.2	148	298.4	182	359.6
81	177.8	115	239.0	149	300.2	183	361.4
82	179.6	116	240.8	150	302.0	184	363.2
83	181.4	117	242.6	151	303.8	185	365.0
84	183.2	118	244.4	152	305.6	186	366.8
85	185.0	119	246.2	153	307.4	187	368.6
86	186.8	120	248.0	154	309.2	188	370.4
87	188.6	121	249.8	155	311.0	189	372.2
88	190.4	122	251.6	156	312.8	190	374.0
89	192.2	123	253.4	157	314.6	191	375.8
90	194.0	124	255.2	158	316.4	192	377.6
91	195.8	125	257.0	159	318.2	193	379.4
92	197.6	126	258.8	160	320.0	194	381.2
93	199.4	127	260.6	161	321.8	195	383.0
94	201.2	128	262.4	162	323.6	196	384.8
95	203.0	129	264.2	163	325.4	197	386.6
96	204.8	130	266.0	164	327.2	198	388.4
97	206.6	131	267.8	165	329.0	199	390.2
98	208.4	132	269.6	166	330.8	200	392.0
99	210.2	133	271.4	167	332.6	201	393.8
100	212.0	134	273.2	168	334.4	202	395.6
101	213.8	135	275.0	169	336.2	203	397.4
102	215.6	136	276.8	170	338.0	204	399.2
103	217.4	137	278.6	171	339.8	205	401.0
104	219.2	138	280.4	172	341.6	206	402.8
105	221.0	139	282.2	173	343.4	207	404.6
106	222.8	140	284.0	174	345.2	208	406.4
107	224.6	141	285.8	175	347.0	209	408.2
108	226.4	142	287.6	176	348.8	210	410.0
109	228.2	143	289.4	177	350.6	211	411.8
110	230.0	144	291.2	178	352.4	212	413.6
111	231.8	145	293.0	179	354.2	213	415.4
112	233.6	146	294.8	180	356.0	214	417.2
113	235.4	147	296.6	181	357.8	215	419.0

TENSILE STRENGTH OF METALS.

Given in pounds per square inch. The values can be considered only as approximation.

Metal.	Tensile strength in lbs. per sq. in.
Aluminum wire	30,000– 40,000
Brass wire	50,000–150,000
Bronze wire, phosphor, hard drawn	110,000–140,000
Bronze, wire, silicon, hard drawn	95,000–115,000
Bronze	60,000– 75,000
Copper wire, hard drawn	60,000– 70,000
Gold wire	20,000
Iron, cast	13,000– 33,000
Iron wire, hard drawn	80,000 120,000
Iron wire, annealed	50,000– 60,000
Lead, cast or drawn	2600– 3300
Palladium	39,000
Platinum wire	50,000
Silver wire	42,000
Steel	80,000–330,000
Steel wire, maximum	460,000
Steel, specially treated nickel steel	250,000
Steel, piano wire, 0.033 in. diam.	357,000 390,000
Steel, piano wire, 0.051 in. diam.	325,000–337,000
Tin, cast or drawn	4000– 5000
Zinc, cast	7000 13,000
Zinc, drawn	22,000– 30,000

DECIMAL EQUIVALENTS.

Of Millimeters and Inches.

m/m		inches.	m/m		inches.	m/m		inches.	m/m		inches.
1–100	=	.00039	35–100	±	.01299	70–100	=	.02756	1	=	.03937
5–100	=	.00197	40–100	±	.01575	75–100	±	.02953	5	=	.19685
10–100	=	.00394	45–100	=	.01772	80–100	=	.03150	10	=	.39370
15–100	=	.00591	50–100	±	.01969	85–100	=	.03346	15	=	.59055
20–100	=	.00787	55–100	±	.02165	90–100	=	.03543	20	=	.78740
25–100	=	.00984	60–100	=	.02362	95–100	=	.03740	25	=	.98425
30–100	=	.01181	65–100	=	.02559	....			26	=	1.02362

Comparison of Wire Gauges.

NUMBER OF WIRE GAUGES EXPRESSED IN DECIMAL PARTS OF AN INCH.

Gauge Nos.	*B. & S. & A. W. Gauge.	**B. W. G. Eng. Standard Stubs.	Twist drill.	Gauge Nos.	*B. & S. & A. W. Gauge.	**B. W. G. Eng. Standard Stubs.	Twist drill.
4.0	.460	.454	.....	19	.03589	.042	.166
3.0	.40964	.425	.....	20	.03196	.035	.161
2.0	.3648	.380	.....	21	.02846	.032	.159
1.0	.32486	.340	.....	22	.02535	.028	.157
1	.2893	.300	.228	23	.02257	.025	.154
2	.25763	.284	.221	24	.0201	.022	.152
3	.22942	.259	.213	25	.0179	.020	.1495
4	.20431	.238	.209	26	.01594	.018	.147
5	.18194	.220	.2055	27	.01419	.016	.144
6	.16202	.220	.204	28	.01264	.014	.1405
7	.14428	.180	.201	29	.01126	.013	.136
8	.12840	.165	.199	30	.01002	.012	.1285
9	.11443	.148	.196	31	.00893	.010	.120
10	.10189	.134	.1935	32	.00795	.009	.116
11	.09074	.120	.191	33	.00708	.008	.113
12	.08081	.109	.189	34	.0063	.007	.111
13	.07196	.095	.185	35	.00561	.005	.110
14	.06408	.083	.182	36	.005	.004	.1065
15	.05707	.072	.180	37	.00445	....	.104
16	.05082	.065	.177	38	.00396	....	.1015
17	.04525	.058	.173	39	.00353	....	.0995
18	.0403	.049	.1695	40	.00314	....	.098

* Brown & Sharpe, or American Wire Gauge.
** Birmingham Wire Guage.

SCALE OF HARDNESS.

1. Talc
2. Rocksalt
3. Calcite
4. Fluorite
5. Apatite
6. Feldspar
7. Quartz
8. Topaz
9. Corundum
10. Diamond

Hardness of Materials.

The numbers give only the order of arrangement as to hardness.

Agate	7.0
Alabaster	1.7
Alum	2–2.5
Aluminum	2.0
Amber	2–2.5
Anthracite	2.2
Antimony	3.3
Apatite	5.0
Arsenic	3.5
Asbestos	5.0
Asphalt	1–2.0
Barite	3.3
Beryl	7.8
Bell-metal	4.0
Bismuth	2.5
Boric acid	3.0
Brass	3–4.0
Calamine	5.0
Calcite	3.0
Copper	2.5–3.0
Corundum	9.0
Diamond	10.0
Dolomite	3.5–4.0
Feldspar	6.0
Flint	7.0
Fluorite	4.0
Galena	2.5
Garnet	7.0
Glass	4.5–6.5
Gold	2.5–3.0
Graphite	0.5–1.0
Gypsum	1.6–2.0
Hematite	6.0
Hornblende	5.5
Iridium	6.0
Iridosmium	7.0
Iron	4–5.0
Kaolin	1.0
Lead	1.5
Magnetite	6.0
Marble	3–4.0
Meerschaum	2–3.0
Mica	2.8
Opal	4–6.0
Palladium	4.8
Phosphor bronze	4.0
Platinum	4.3
Plat. iridium	6.5
Pyrite	6.3
Quartz	7.0
Rocksalt	2.0
Ross' metal	2.5–3.0
Silver chloride	1.3
Sulphur	1.5–2.5
Stibnite	2.0
Serpentine	3–4.0
Silver	2.5–3.0
Steel	5–8.5
Talc	1.0
Tin	1.5
Topaz	8.0
Wax (0°)	0.2
Wood's metal	3.0
Zinc	2.5

CHEMICAL EQUIPMENT FOR A SMALL DENTAL LABORATORY.[1]

1	Prescription balance. Pans 6 inches in diameter. Capacity 500 grams in each pan; sensitive to 5 centigrams.
1	set of weights—200 grams to 1 centigram.
1	set of weights—1 ounce to ½ grain Apothecaries' coin weight.
1	dozen glass-stoppered reagent bottles—8 ounces.
1	dozen “ salt mouth bottles—4 ounces.
½	dozen “ “ “ “ —8 ounces.
2	glass funnels; one—2 inches diameter, one—4 inches, diameter.
2	dozen test-tubes, thin walled, with lip, length 6 inches, ¾ inch diameter.
1	test-tube rack, wood, 12 holes.
1	“ holder, wire spring.
2	“ brushes.
1	galvanized iron tripod, 7½ inches high.
1	Nichrome wire gauze for tripod.
3	Erlenmeyer flasks, one 4 ounces, one 8 ounces, one 16 ounces.
1	nest of beaker glasses, with lip, 1–8 ounces.
1	porcelain casserole, wood handle and cover, 1 pint.
1	porcelain evaporating dish, 4 ounces.
100	sheets of filter paper, 10 cm. diameter.
100	“ “ “ 15 cm. diameter.
1	porcelain mortar and pestle, shallow—7¾ inches.
1	cylindrical minim graduate—60 minims.
1	“ graduate—4 ounces
1	“ “ —8 ounces.
1	chemical thermometer, engraved on stem, 100° C.
1	dozen pipettes with rubber bulbs—3½ inches.
3	glass stirring rods; 8, 10 or 12 inches.
½	pound glass tubing, assorted sizes.
	rubber tubing.

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[1] The complete Chemical Laboratory Equipment may be obtained from Arthur H. Thomas Company, West Washington Square, Philadelphia, Pa.

50 assorted corks.
1 steel spatula, wooden handle, 3 inch blade.
1 box paper labels, gummed, Dennison—1½ x 2½ inches.
1 " " " " " —¾ x 1 inch.
1 Acme flour sieve—1 quart.
1 Fletcher crucible furnace No. 40.
1 Dixon plumbago crucible No. 00.
1 urinometer and cylinder.
1 carton "Soloid" Fehling's test tablets.
Litmus test papers, red and blue.

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